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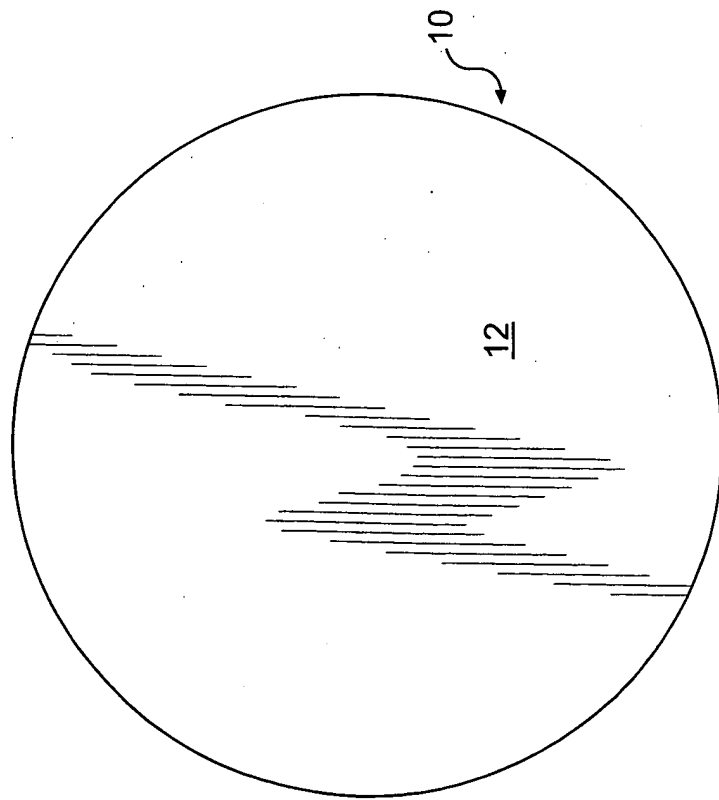
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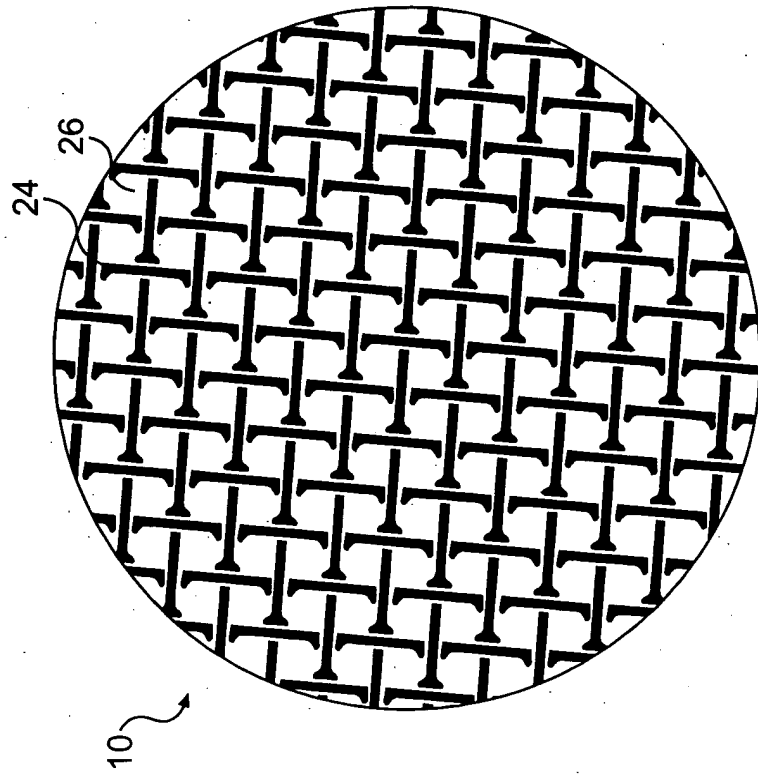
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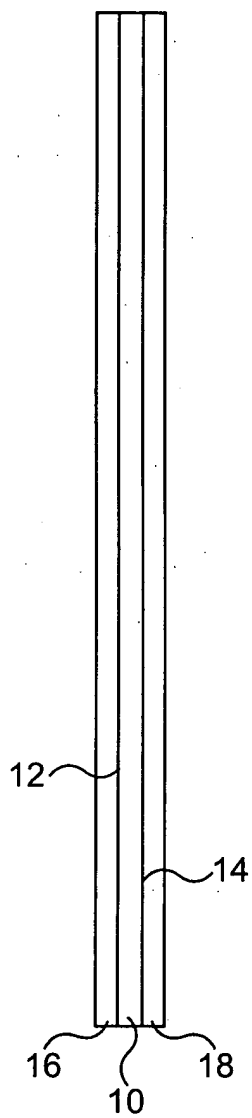
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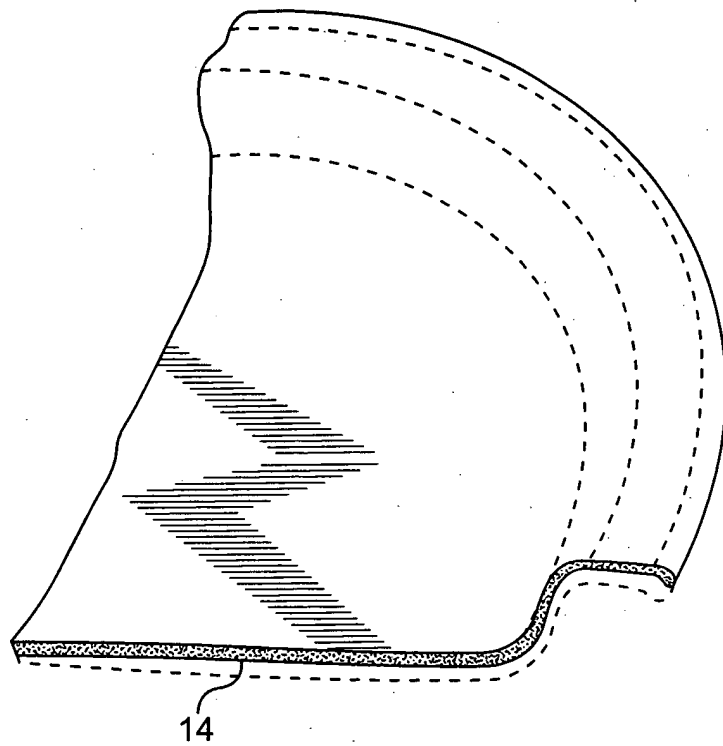
**FIG. 1A**



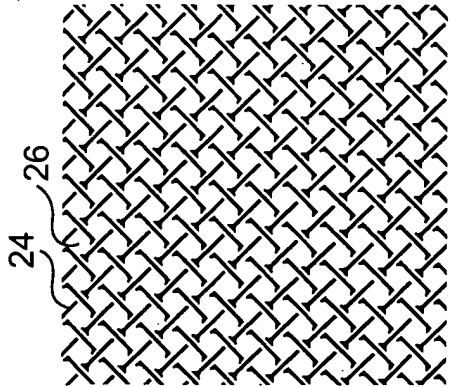
**FIG. 1B**



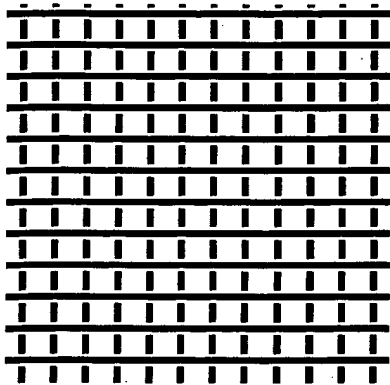
**FIG. 2**



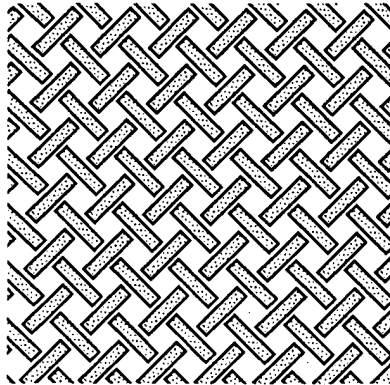
**FIG. 3**



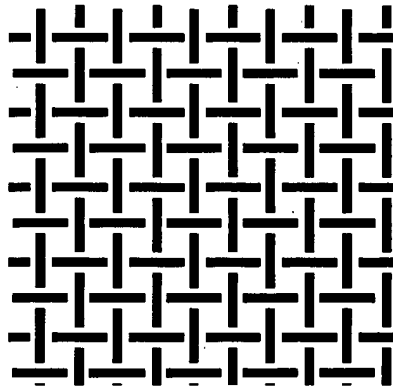
**FIG. 4A**



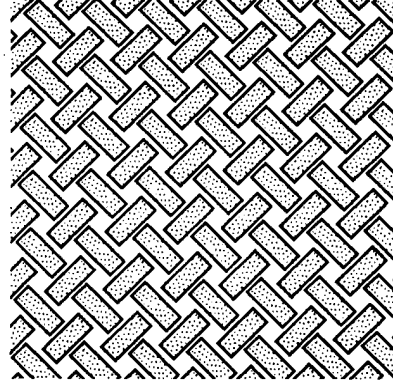
**FIG. 4B**



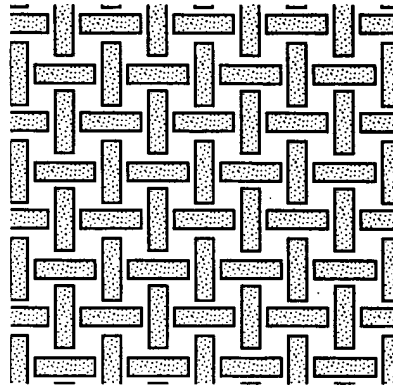
**FIG. 4C**



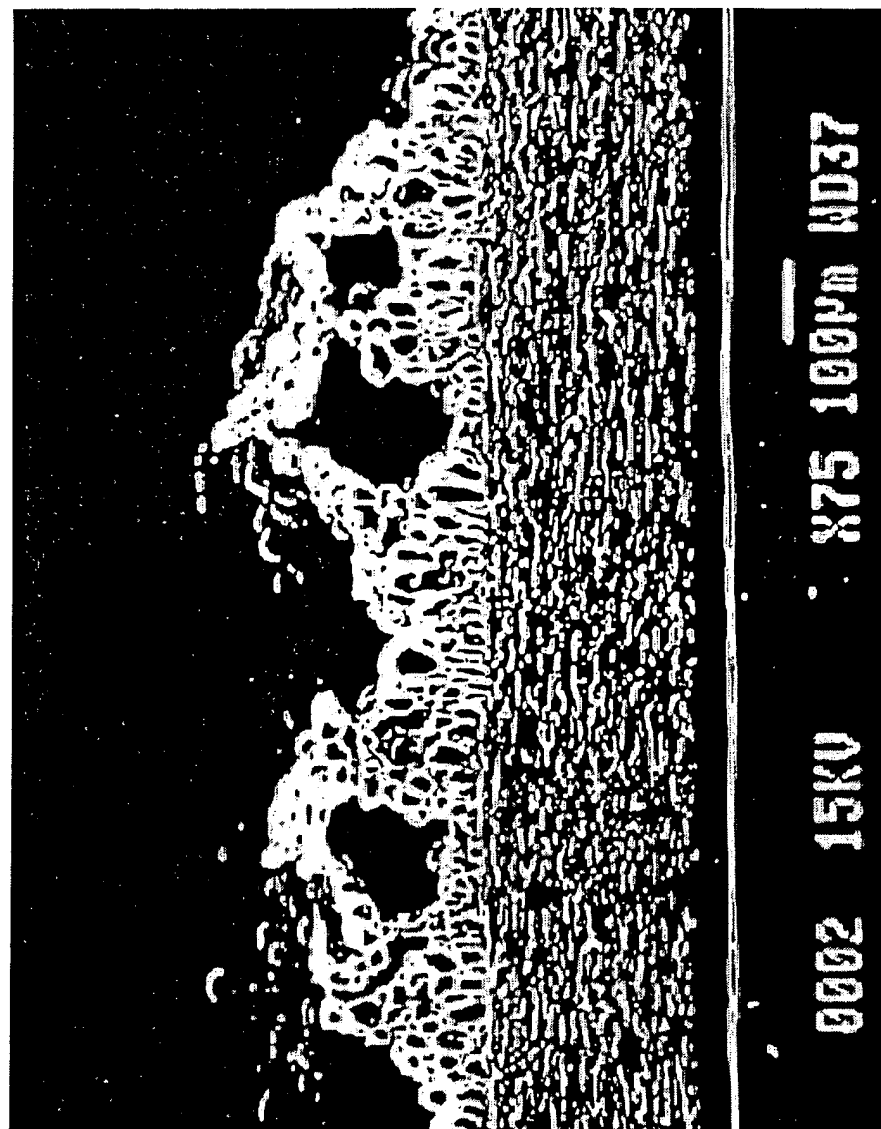
**FIG. 4D**



**FIG. 4E**



**FIG. 4F**



**FIG. 5**

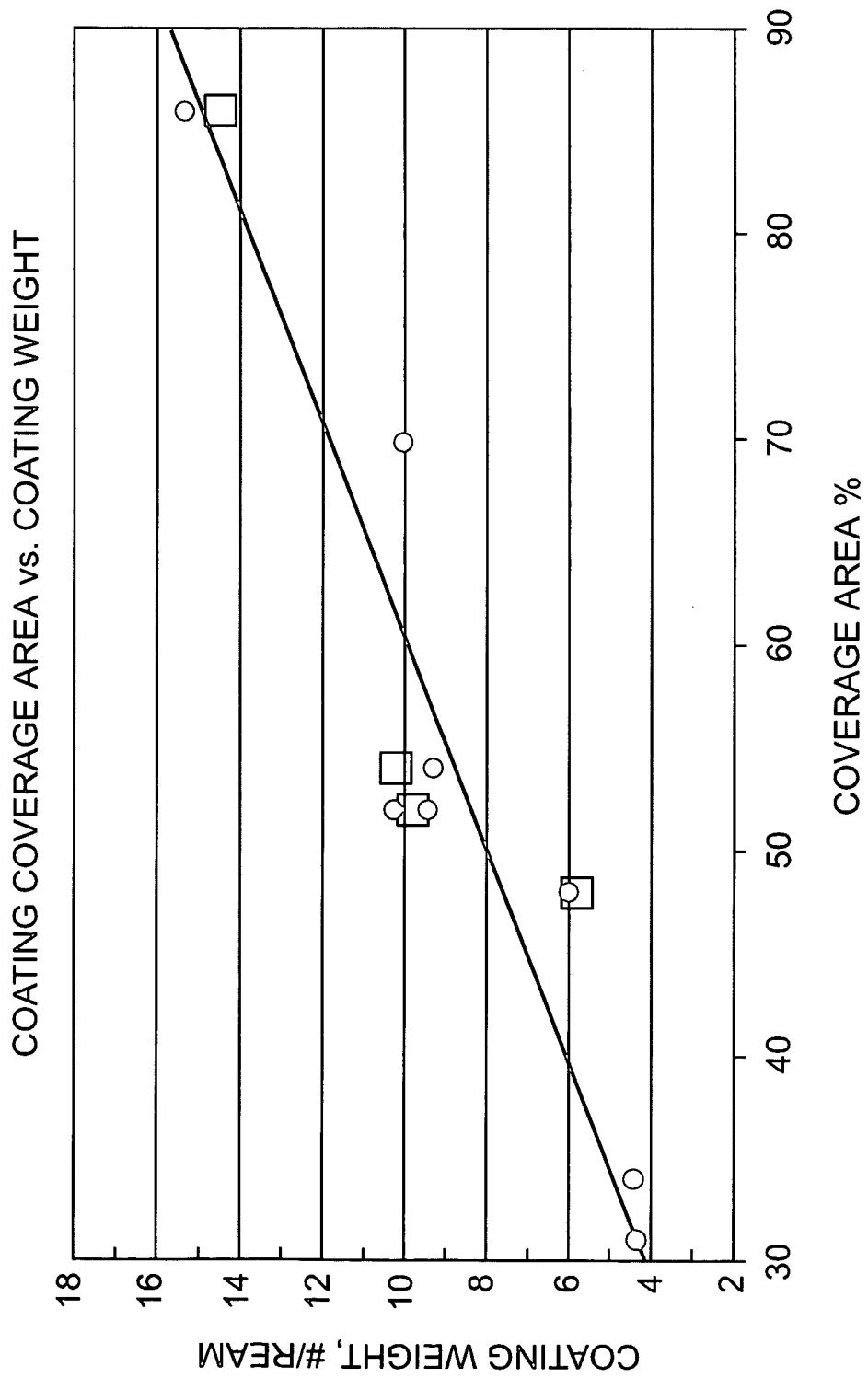


FIG. 6

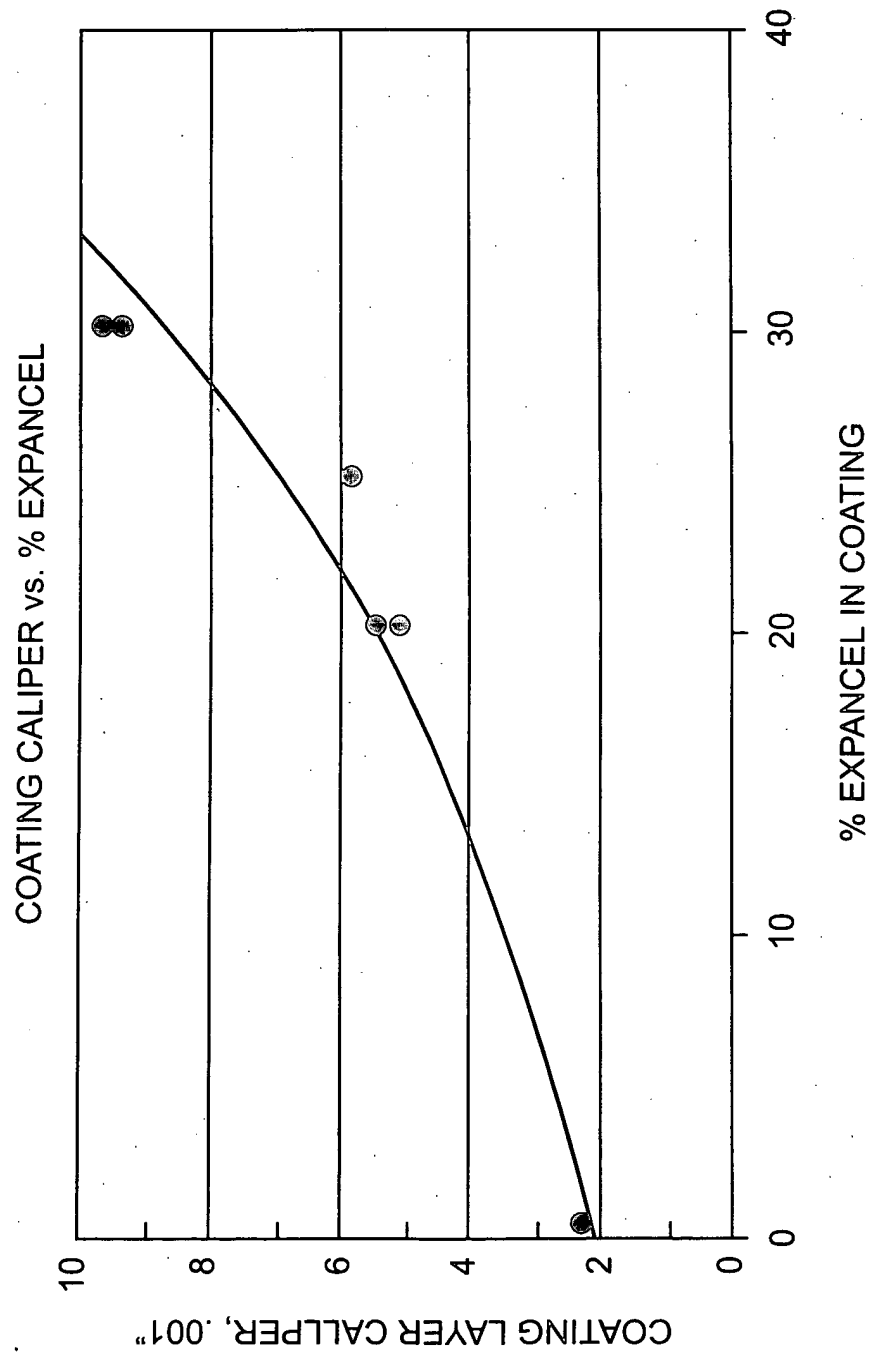


FIG. 7



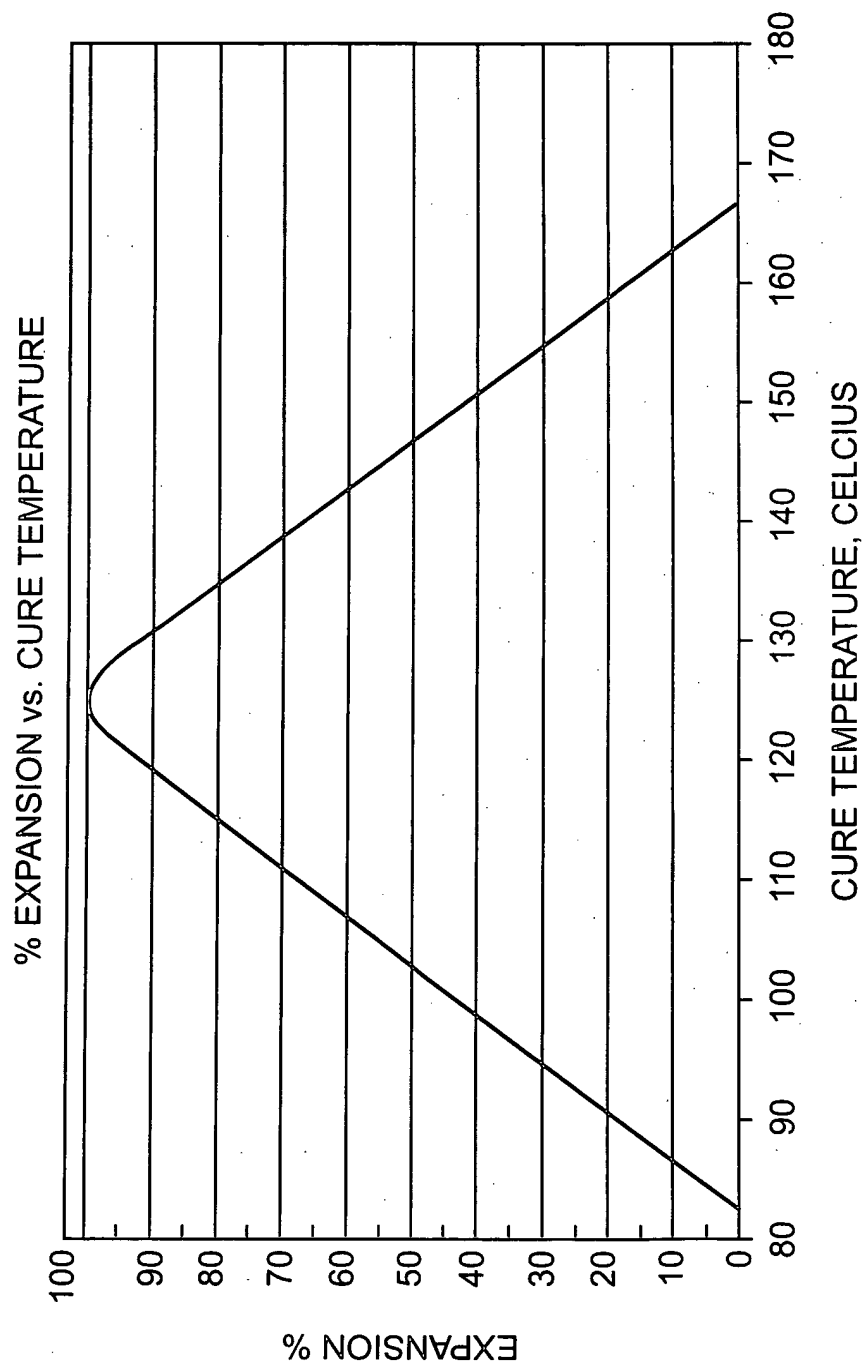


FIG. 8

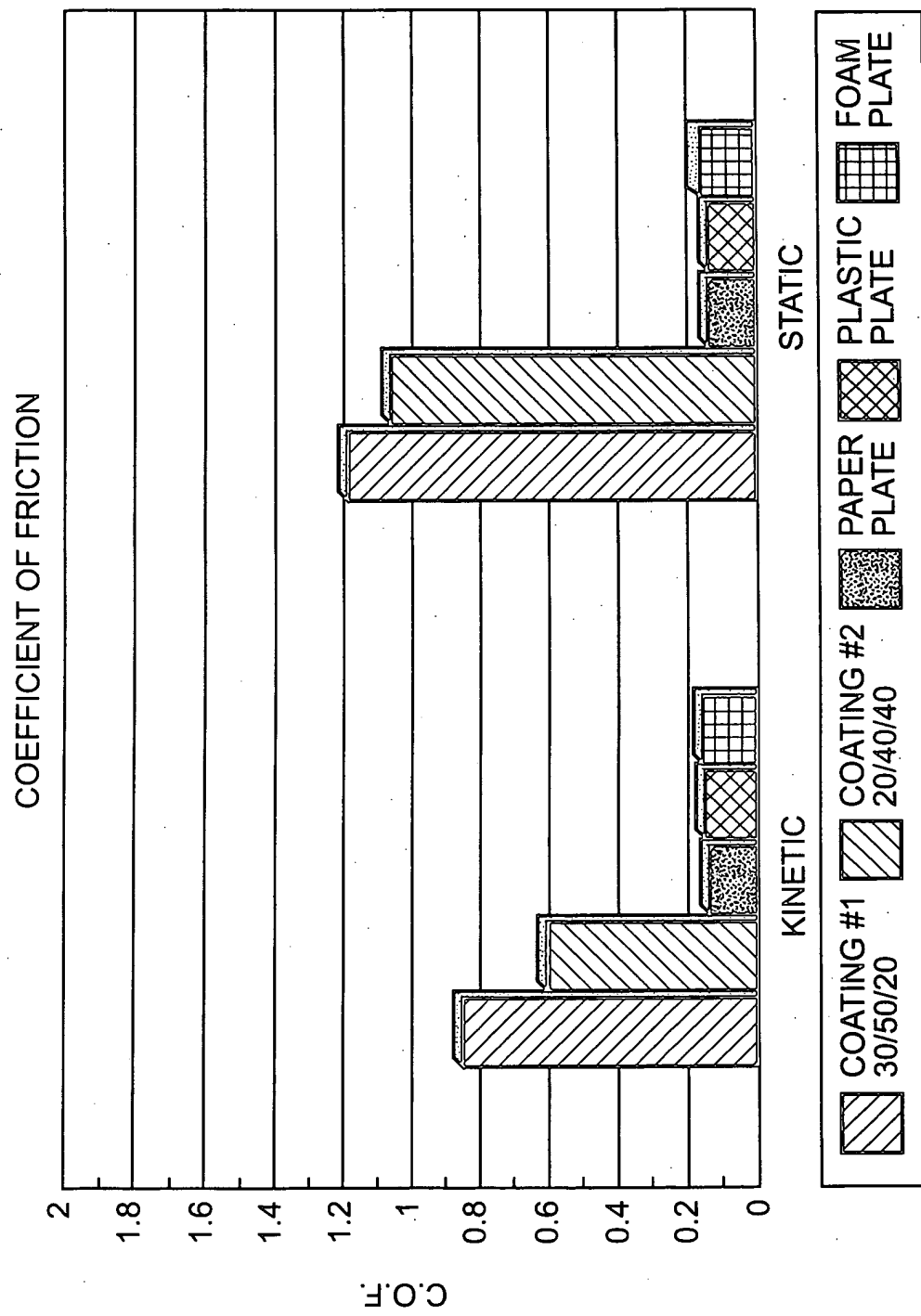
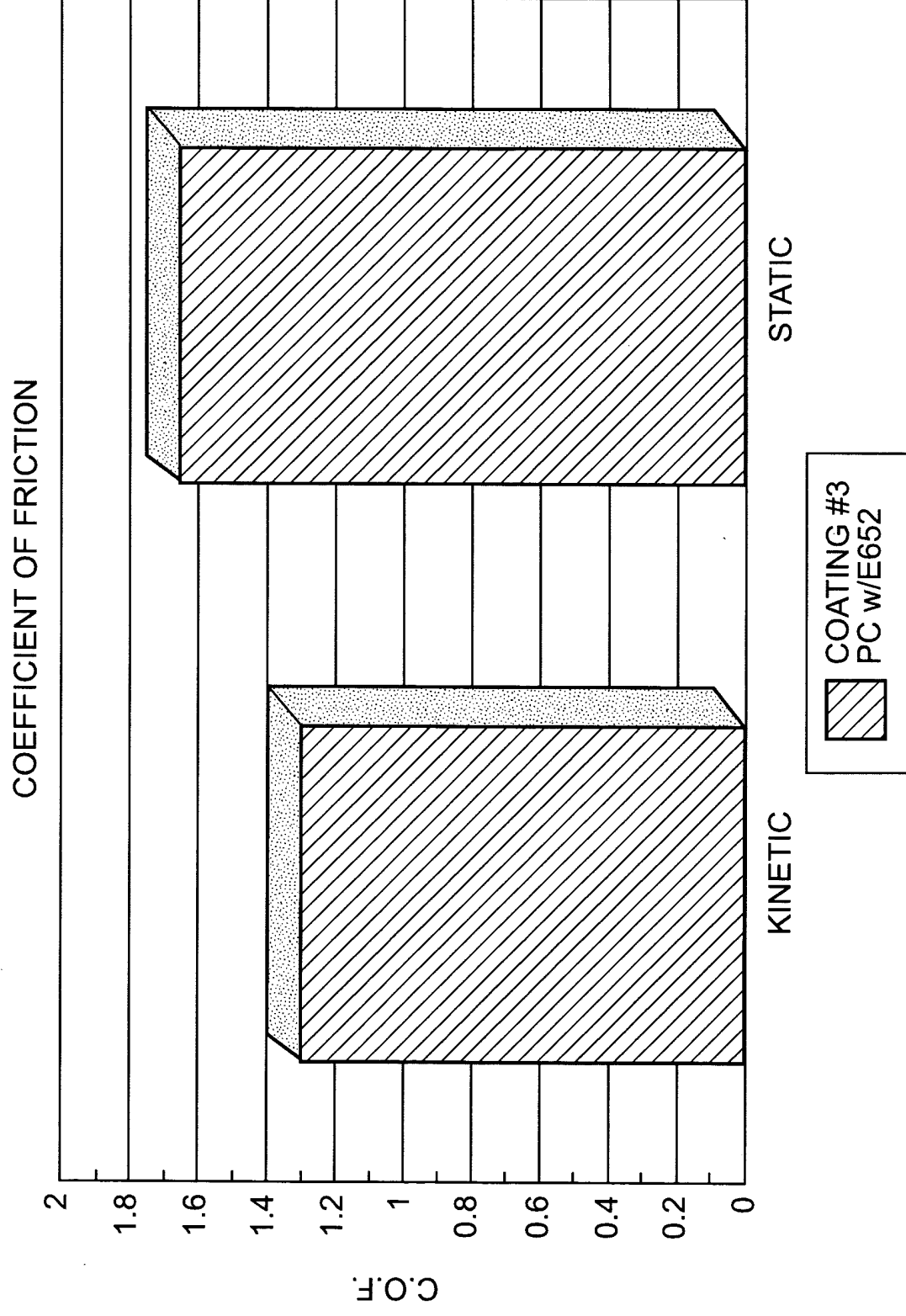
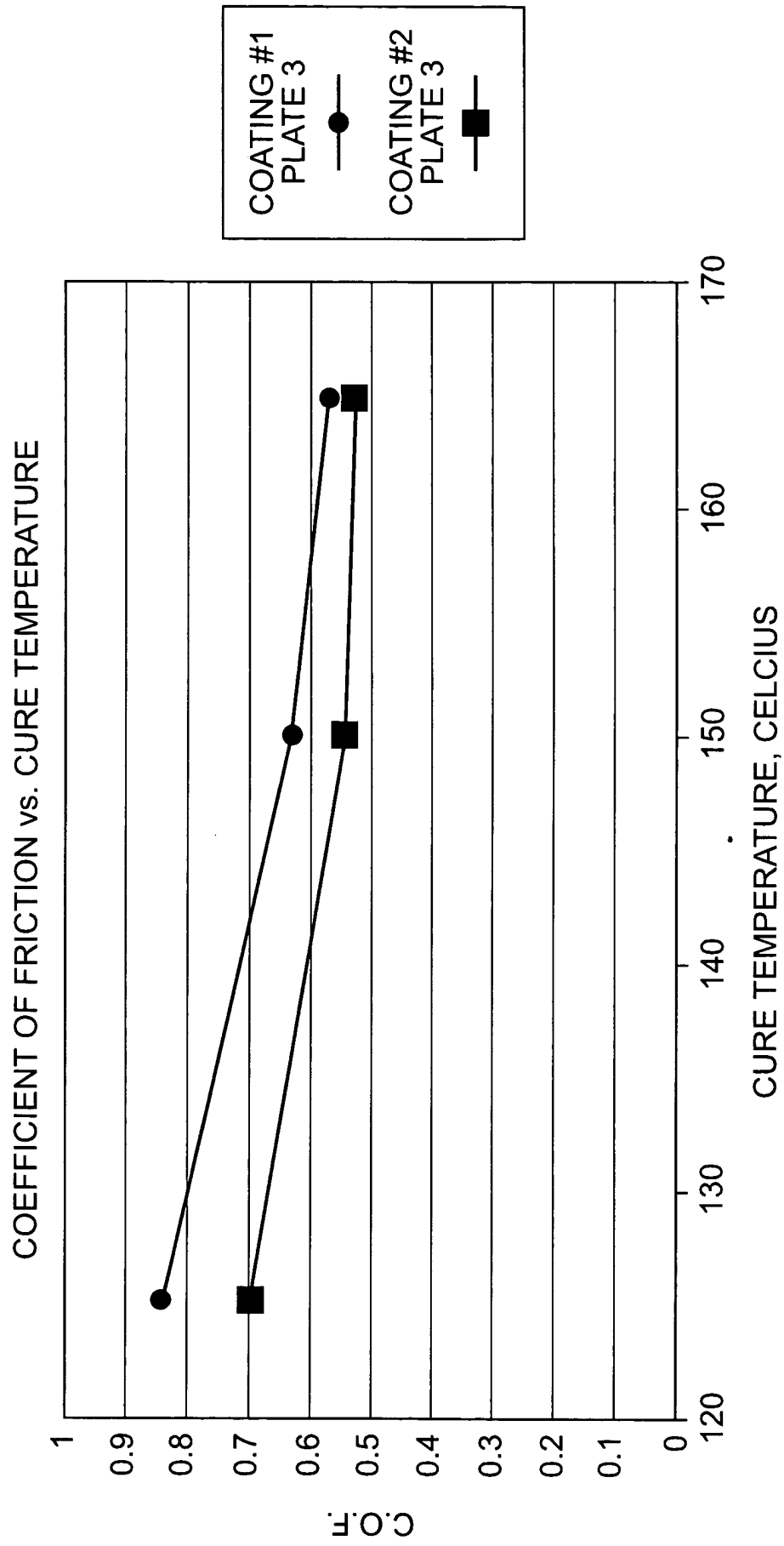


FIG. 9A



**FIG. 9B**



**FIG. 10**

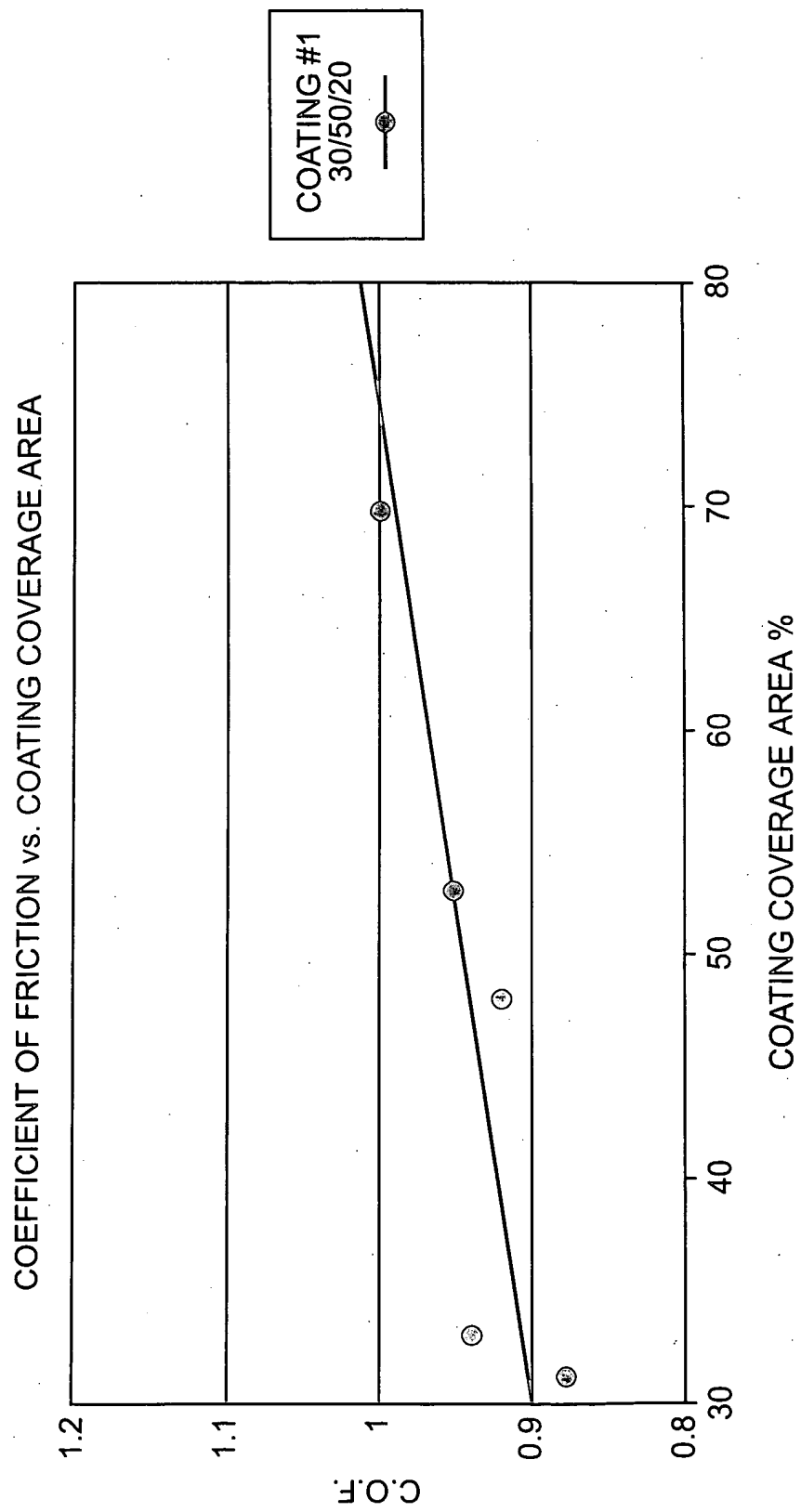


FIG. 11

GARNS HEAT TRANSFER TEST  
COATING FORMULATION #1

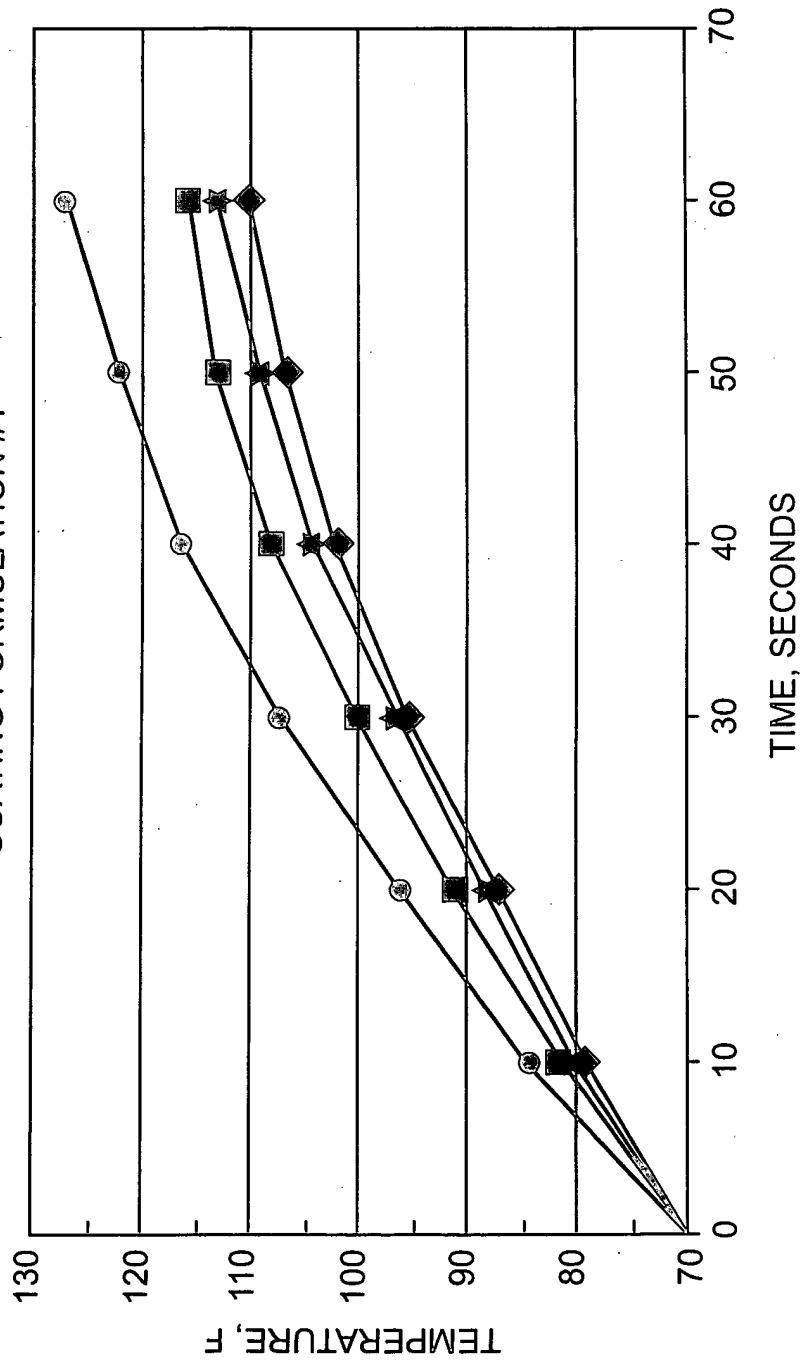


FIG. 12

# GARNS HEAT TRANSFER TEST COATING FORMULATION #1

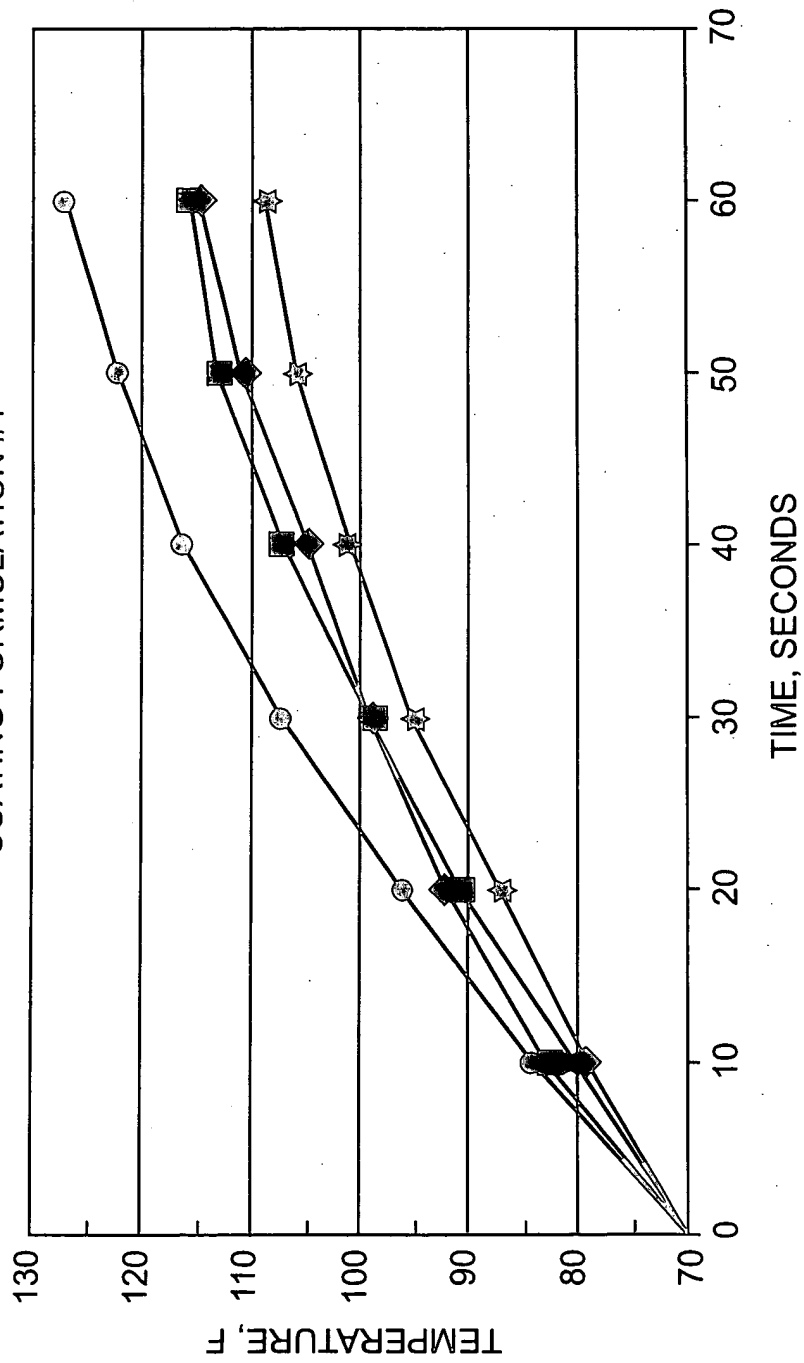


FIG. 13

GARNS HEAT TRANSFER TEST

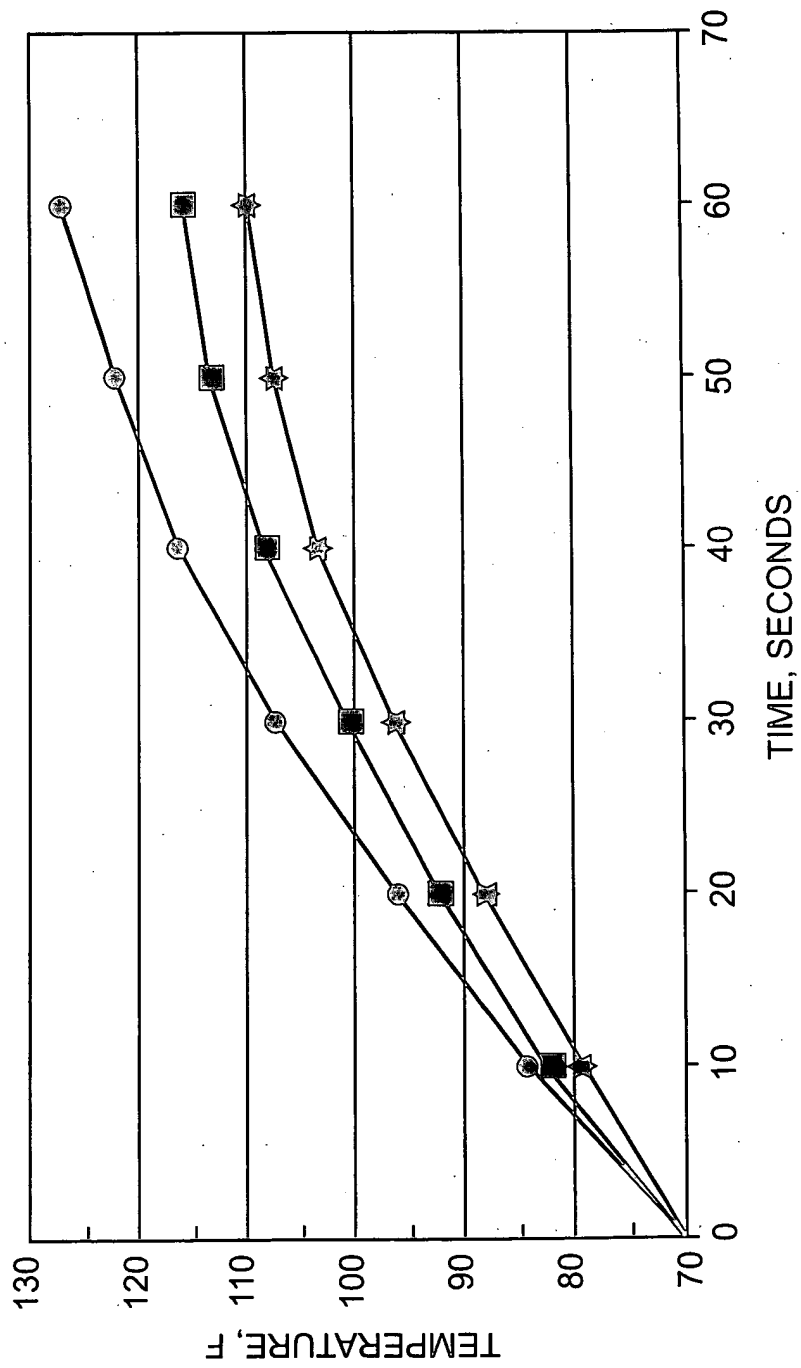
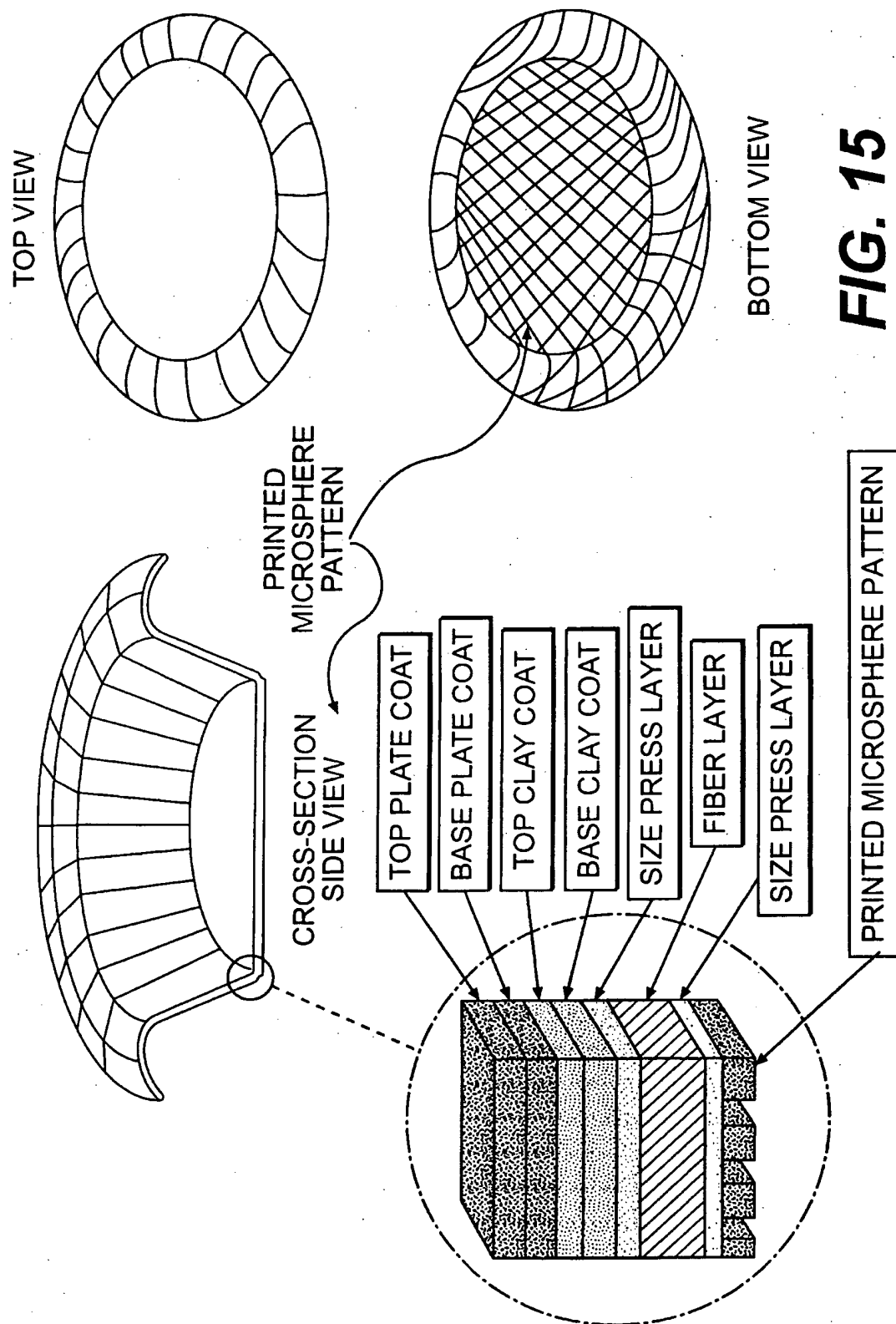


PLATE CONTROL  
PLATE PATTERN2 30/50/20  
PLATE PATTERN2 20/40/40

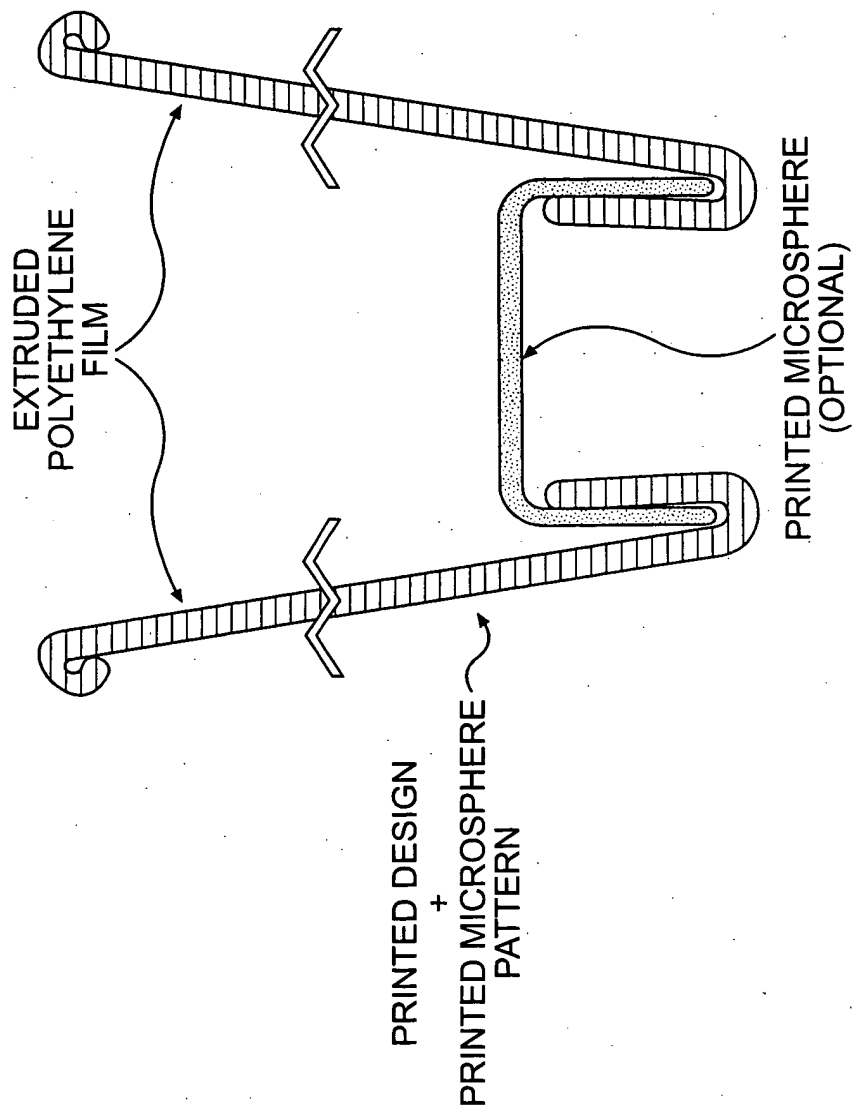
FIG. 14





**FIG. 15**

CROSS-SECTION THROUGH A CUP



**FIG. 16**

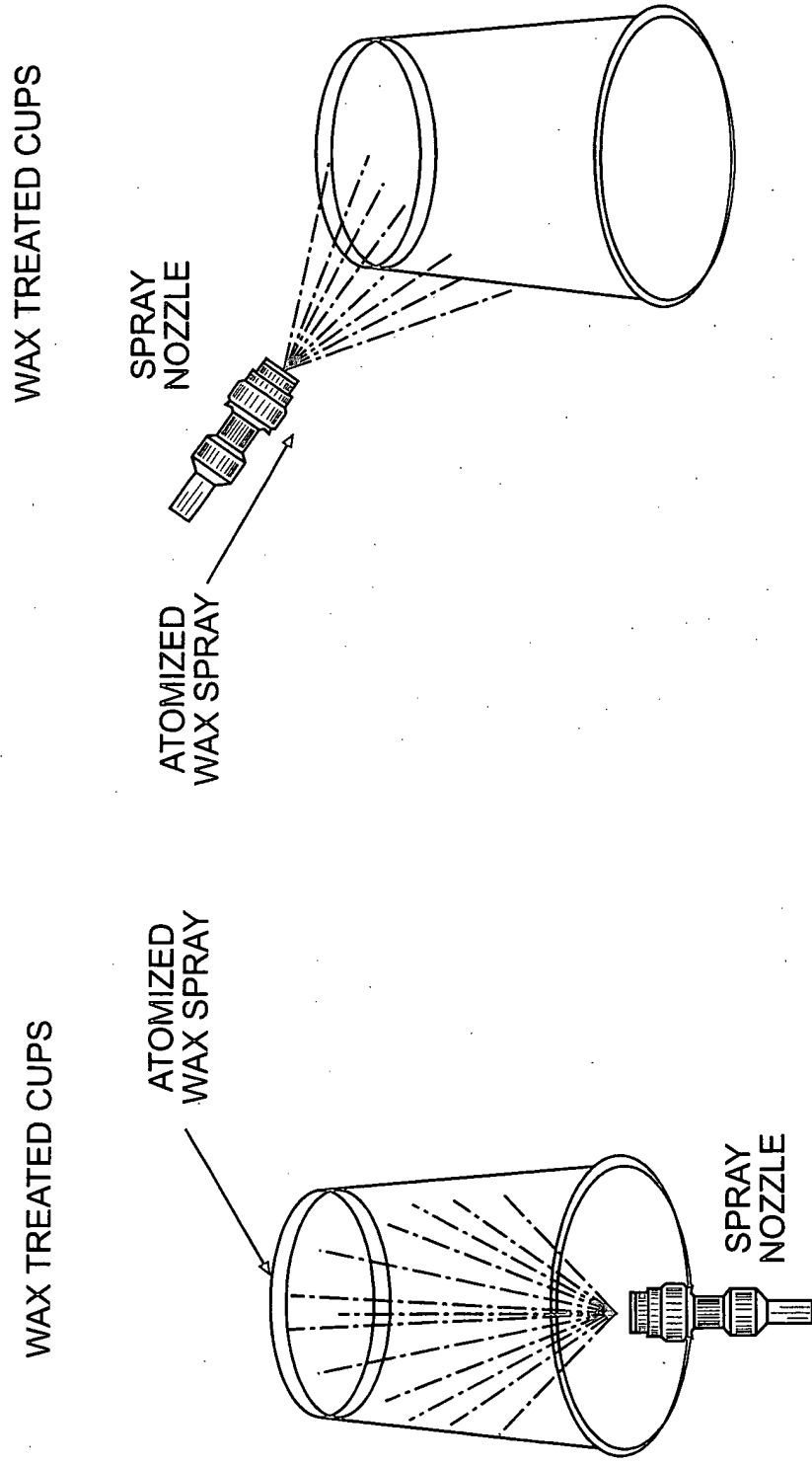
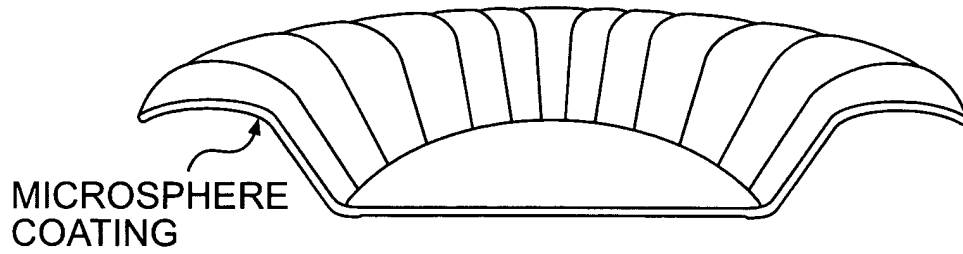


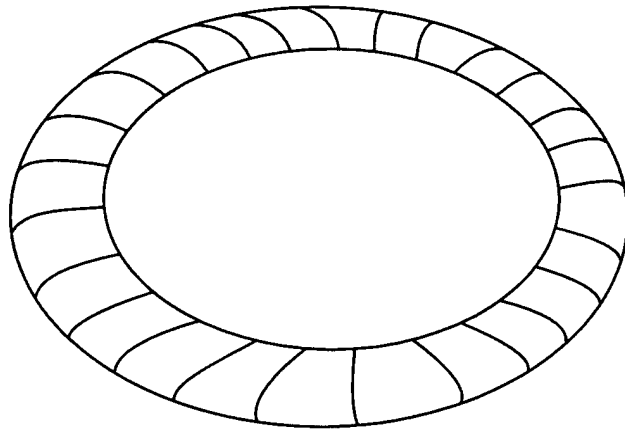
FIG. 17A

FIG. 17B

PLATE



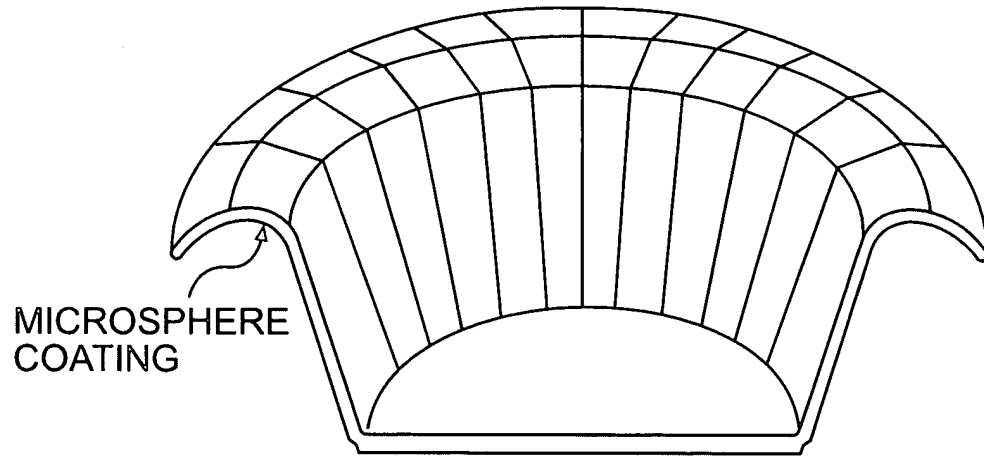
SIDE VIEW



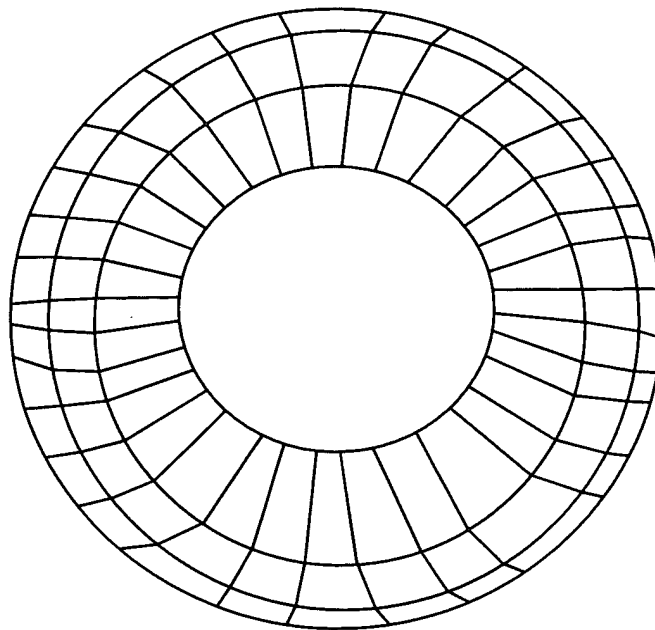
TOP VIEW

**FIG. 18**

BOWL



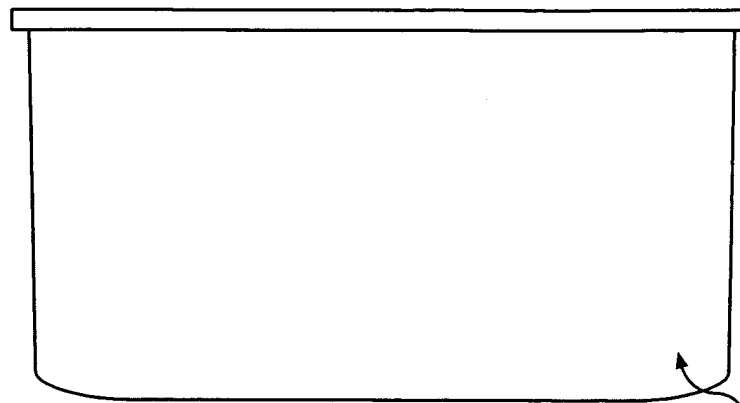
SIDE VIEW



TOP VIEW

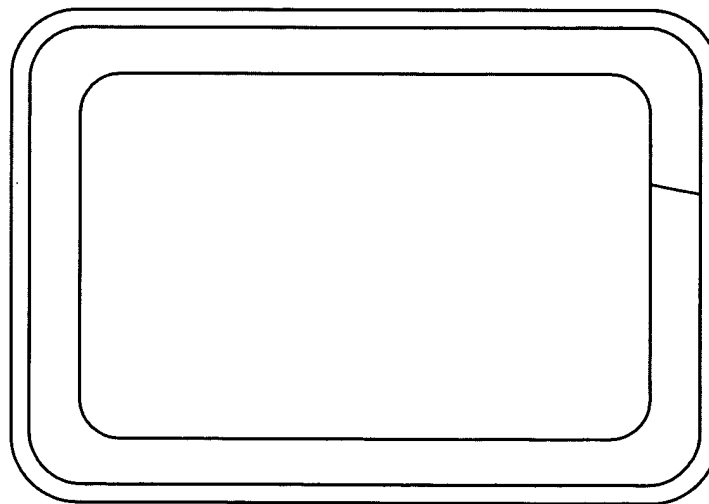
***FIG. 19***

CANISTER



SIDE VIEW

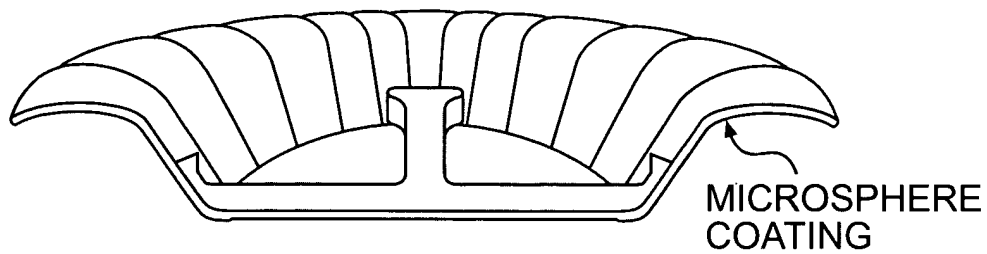
MICROSPHERE  
COATING



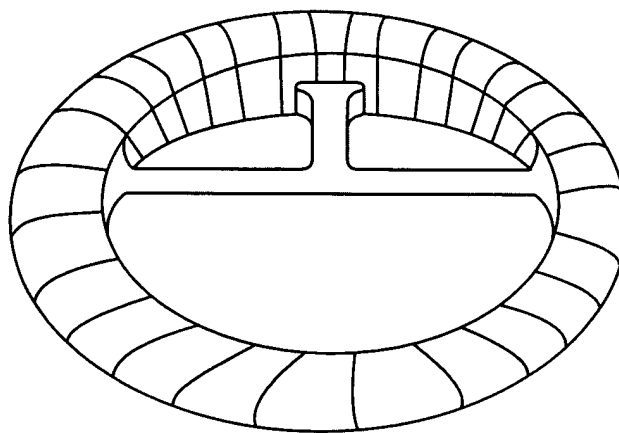
TOP VIEW

**FIG. 20**

COMPARTMENTED  
PLATE



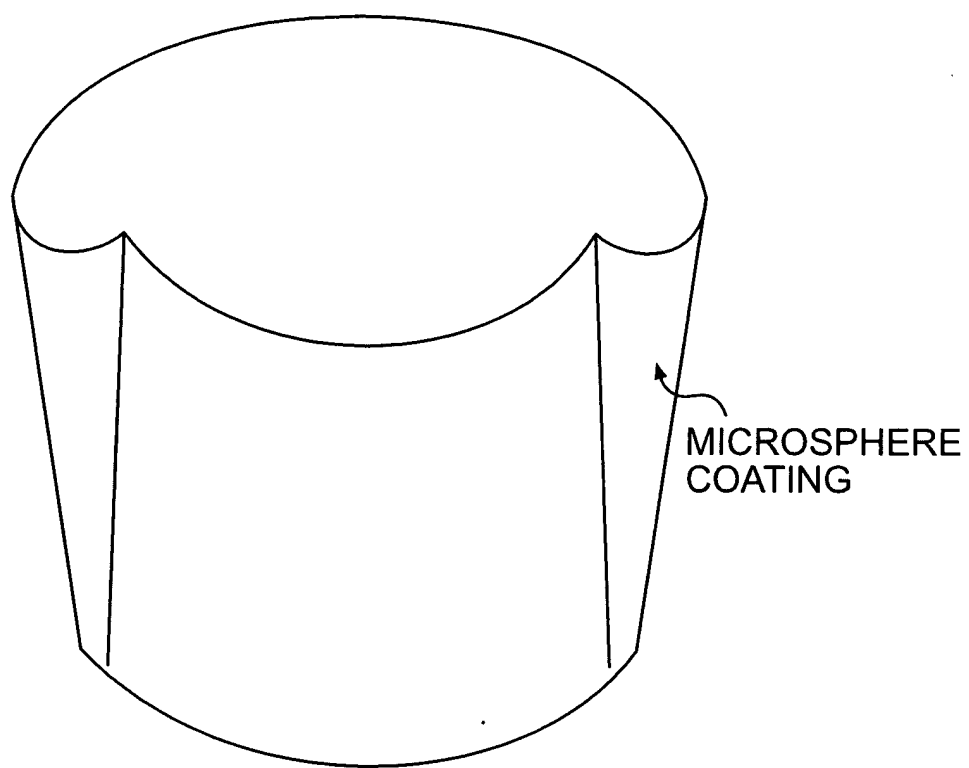
SIDE VIEW



TOP VIEW

**FIG. 21**

FRENCH FRIES SLEEVE

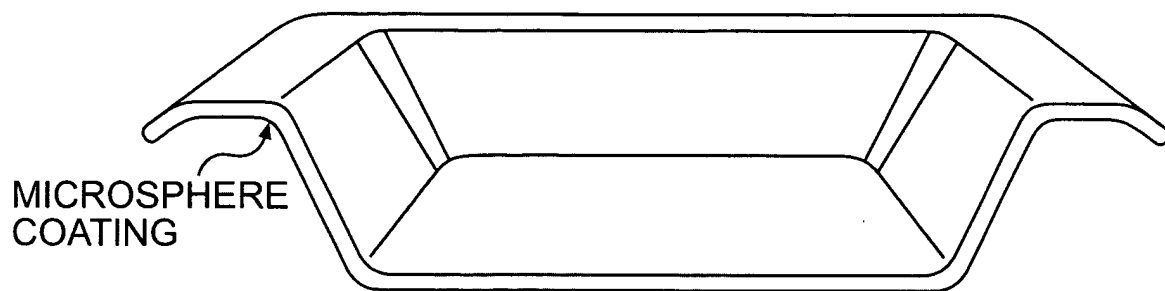


SIDE VIEW

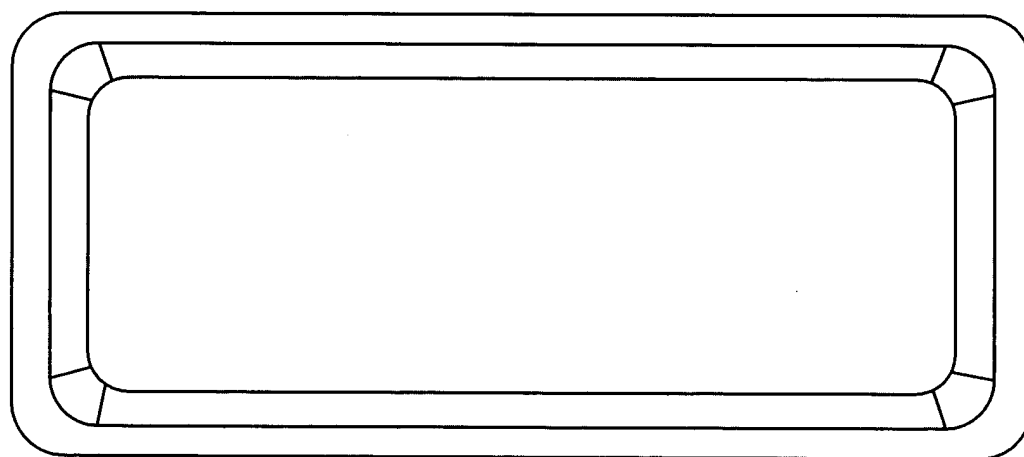
***FIG. 22***



# RECTANGULAR TAKE-OUT CONTAINER



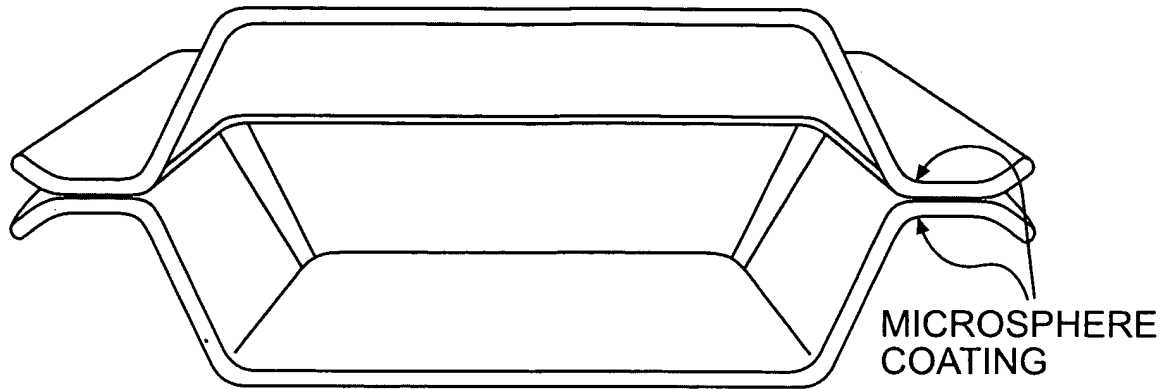
SIDE VIEW



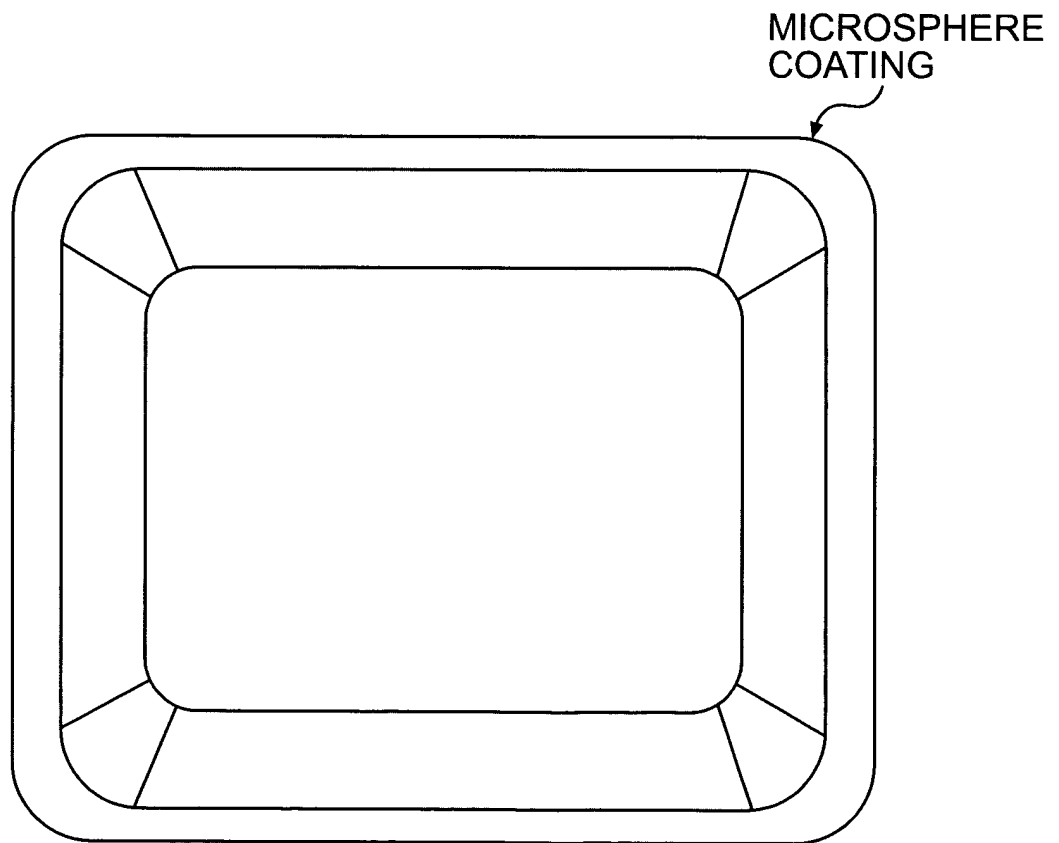
TOP VIEW

**FIG. 23**

# HAMBURGER CLAMSHELL

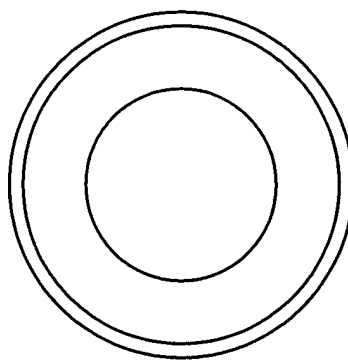
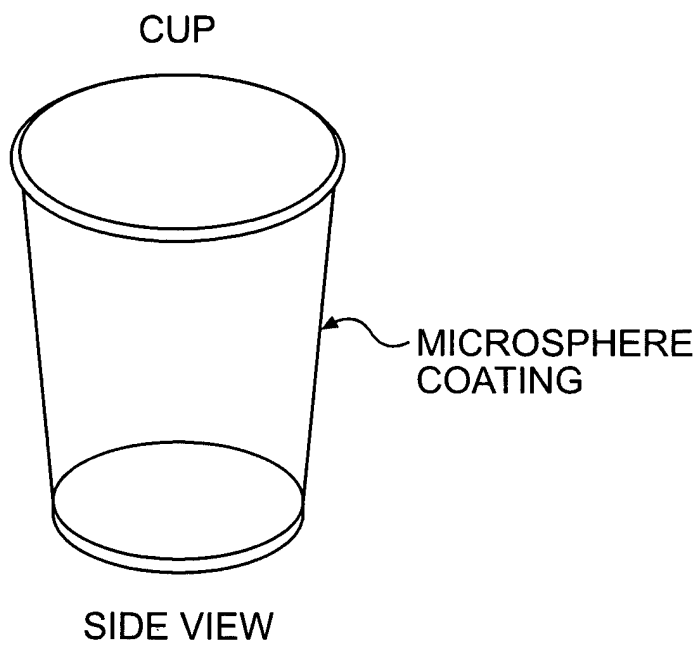


SIDE VIEW



TOP VIEW

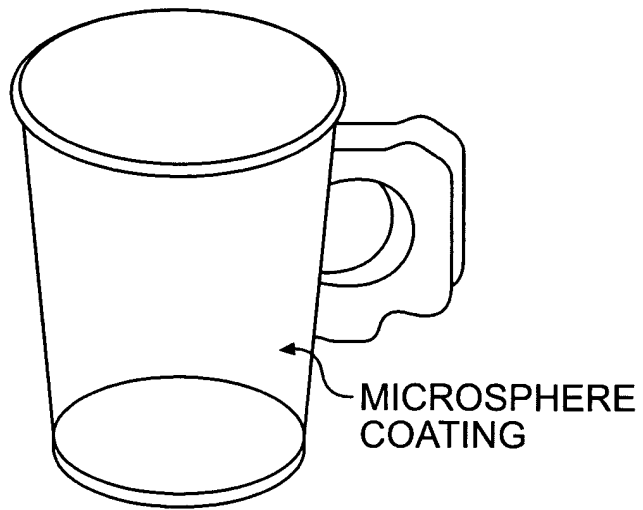
**FIG. 24**



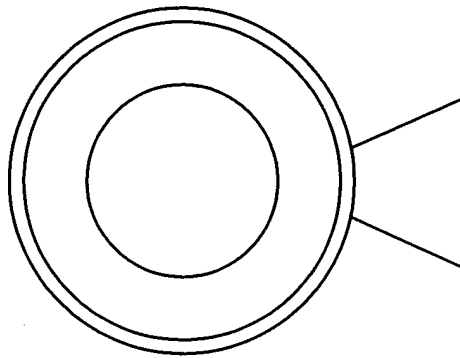
TOP VIEW

**FIG. 25**

CUP



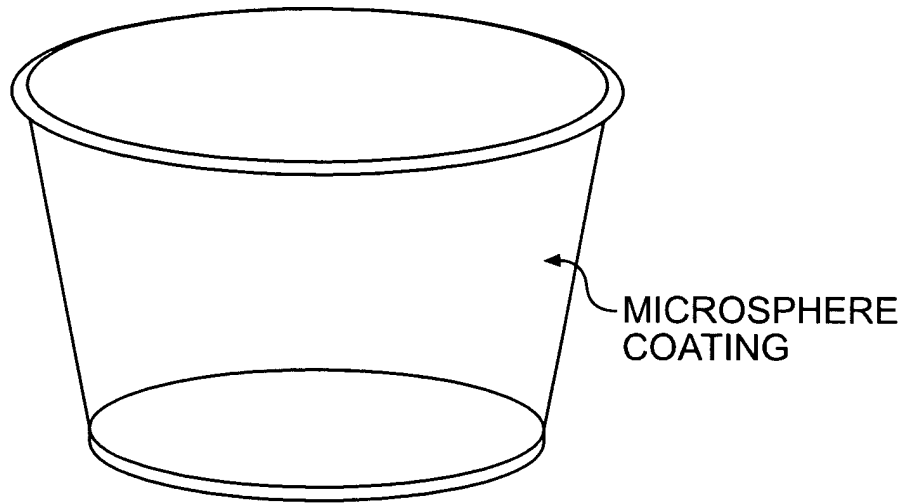
SIDE VIEW



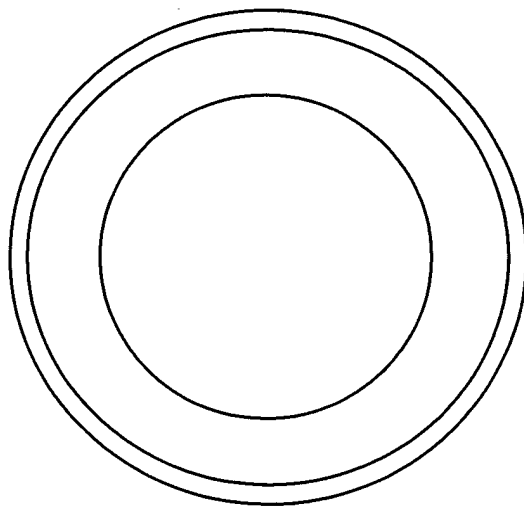
TOP VIEW

**FIG. 26**

FOOD BUCKET



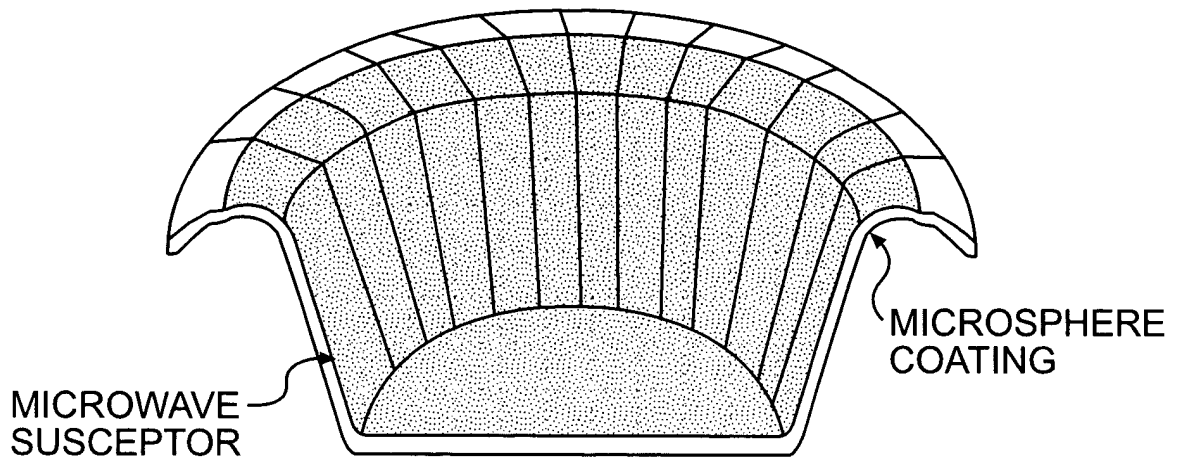
SIDE VIEW



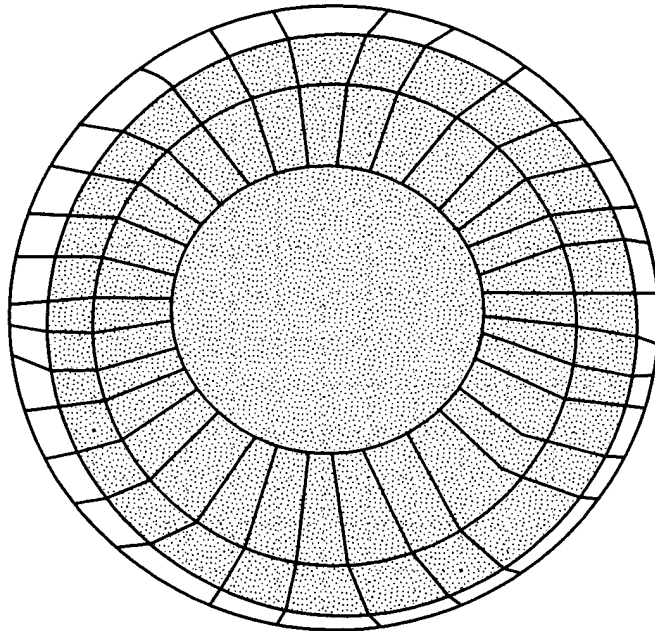
TOP VIEW

**FIG. 27**

# BOWL WITH MICROWAVE SUSCEPTOR LAYER



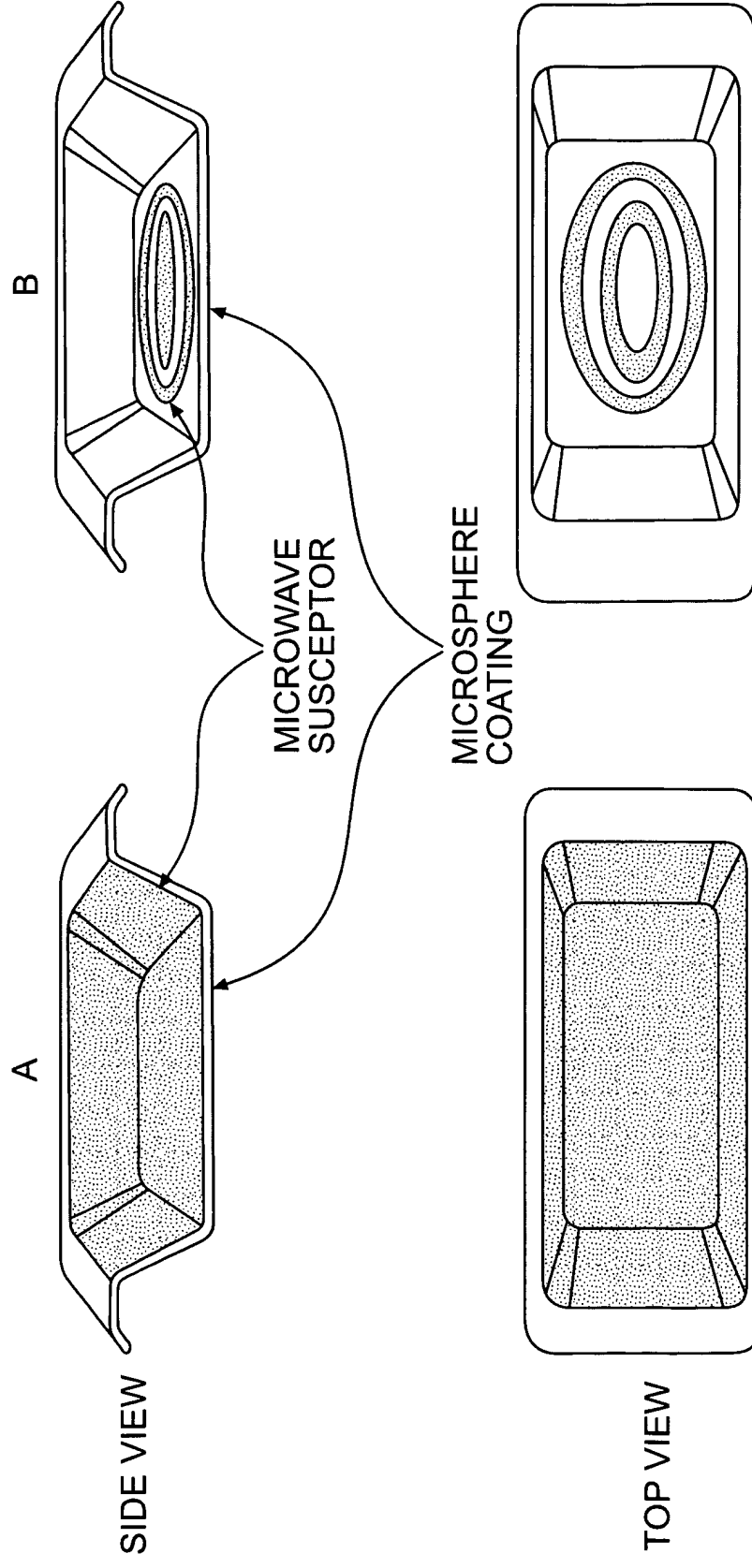
SIDE VIEW



TOP VIEW

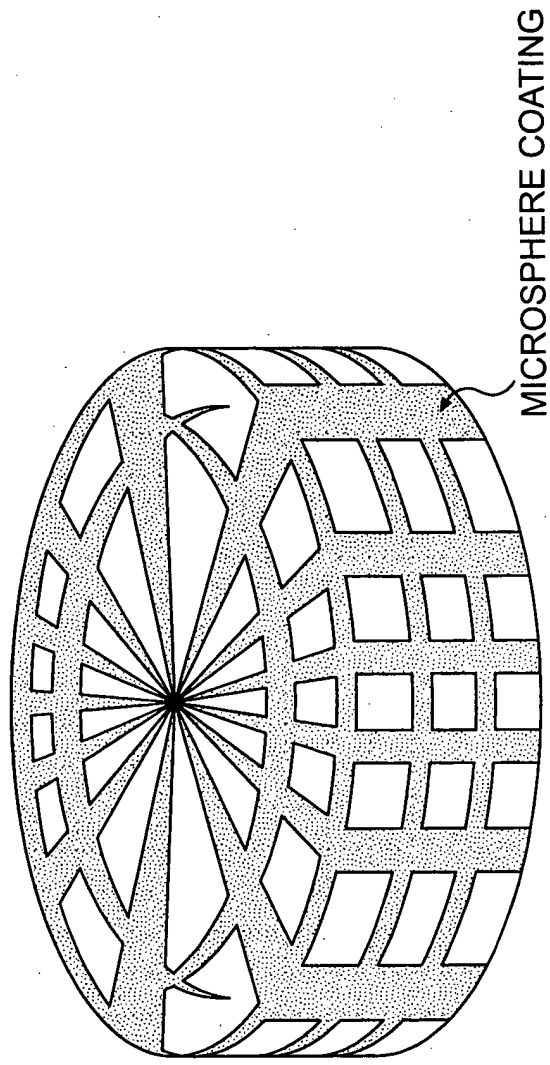
**FIG. 28**

FOOD CONTAINER WITH  
MICROWAVE SUSCEPTOR LAYER



**FIG. 29**

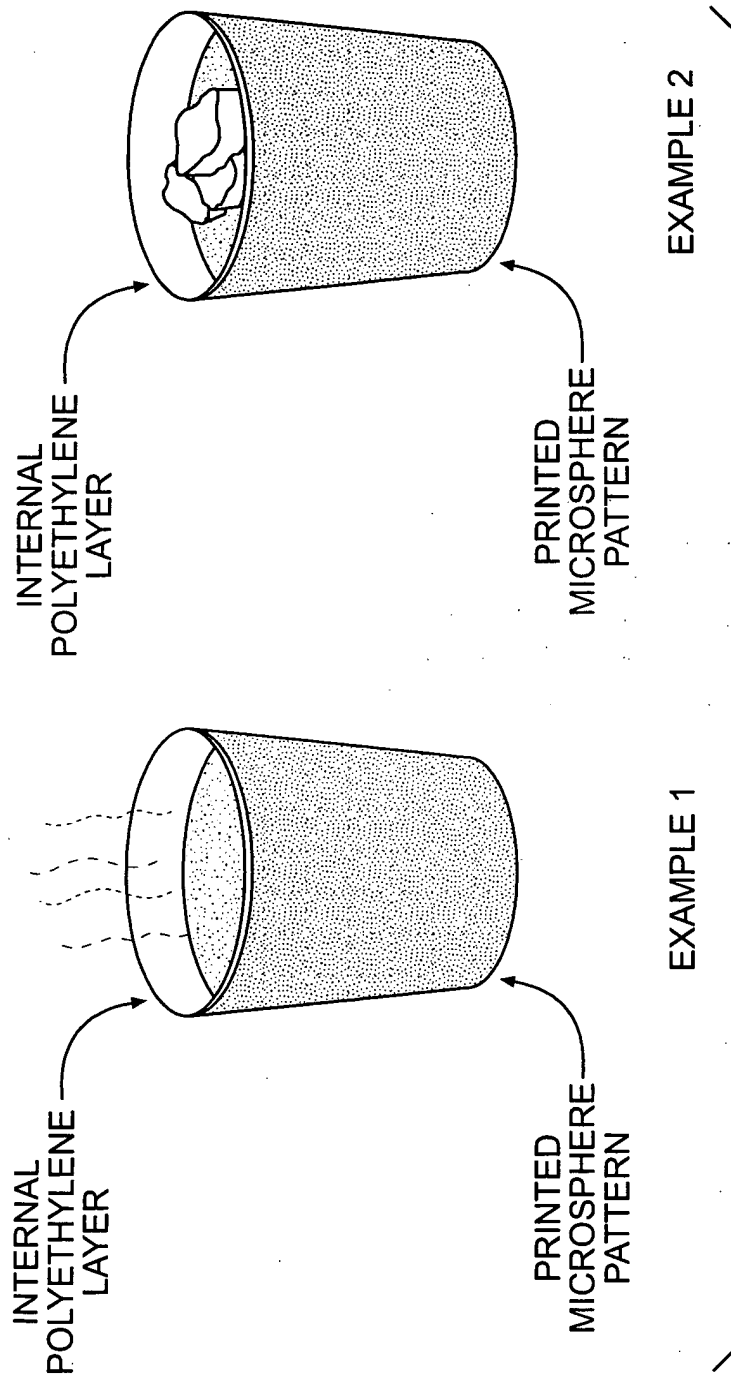
HAMBURGER WRAP  
WITH PRINTED MICROSPHERE PATTERN



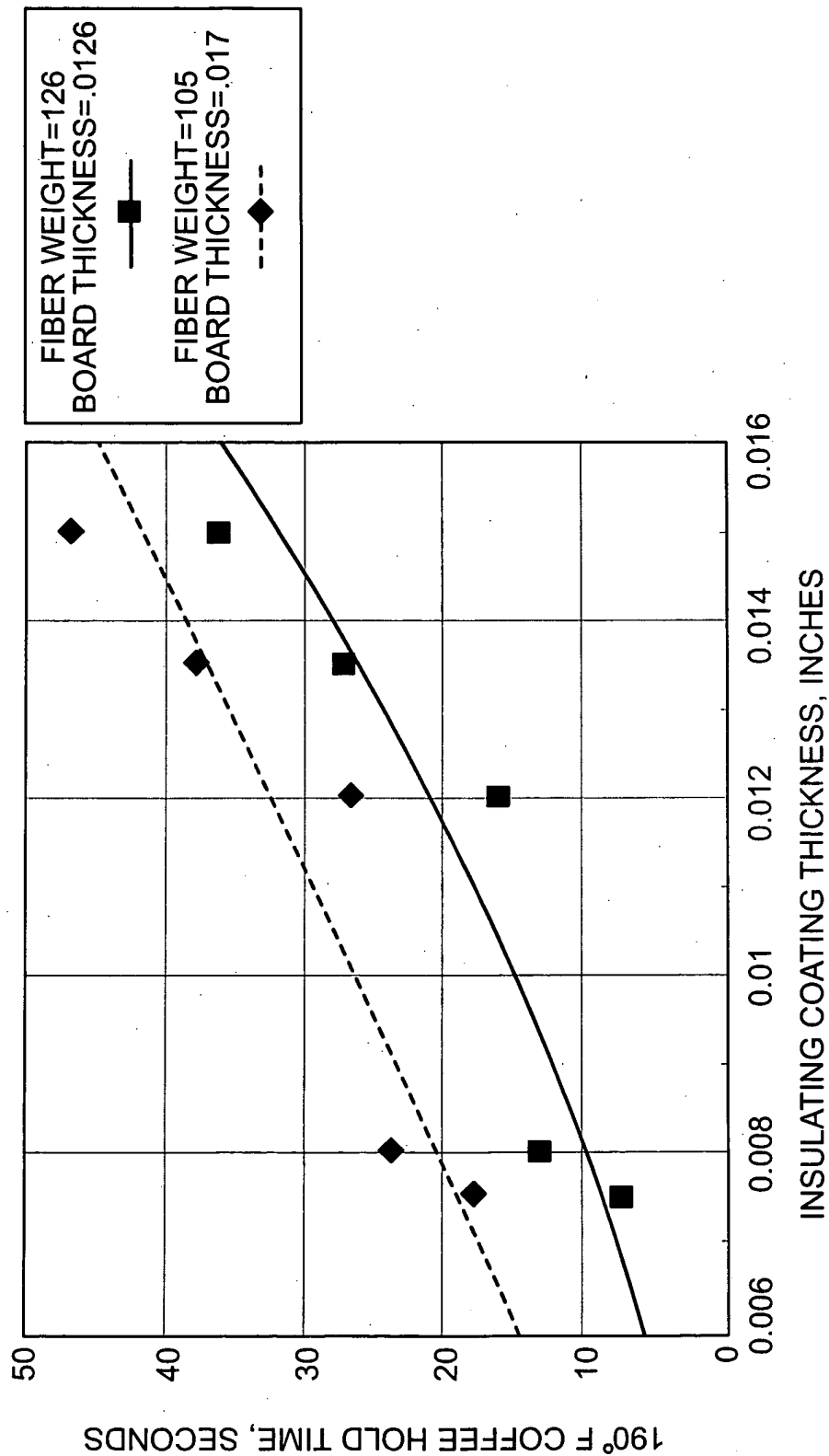
**FIG. 30**



APPLICATION FOR HOT AND COLD CUPS



HOT CUP HOLD TIME VS INSULATING COATING THICKNESS  
FOR COFFEE AT 190°F



1. COATING IS 80% ACRONAL S504 AND 20% EXPANCEL 007
2. FIBER WEIGHT IS LBS/3000 SQ. FEET AND THICKNESS IN INCHES.

**FIG. 32**

HOT CUP HOLD TIME VS COATING THICKNESS

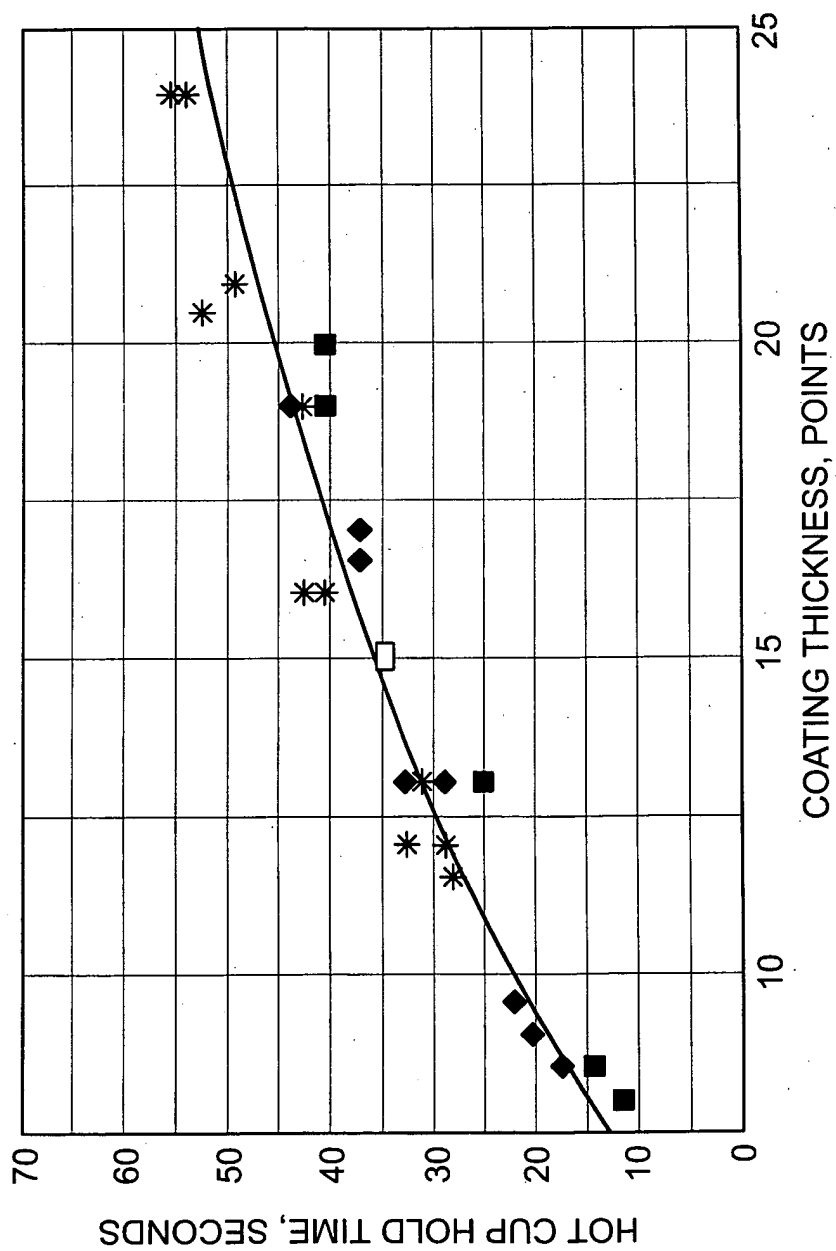
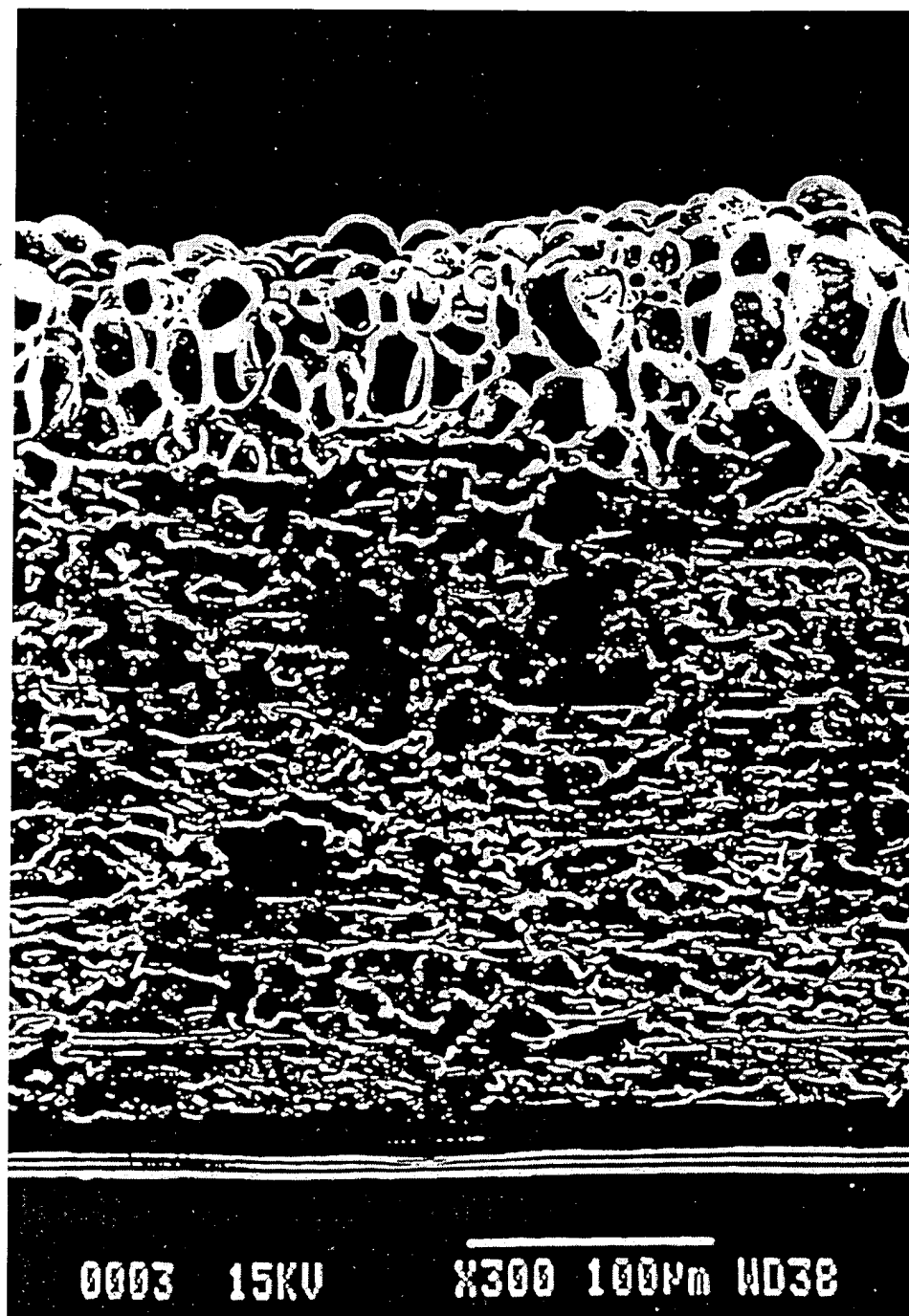


FIG. 33



**FIG. 34**

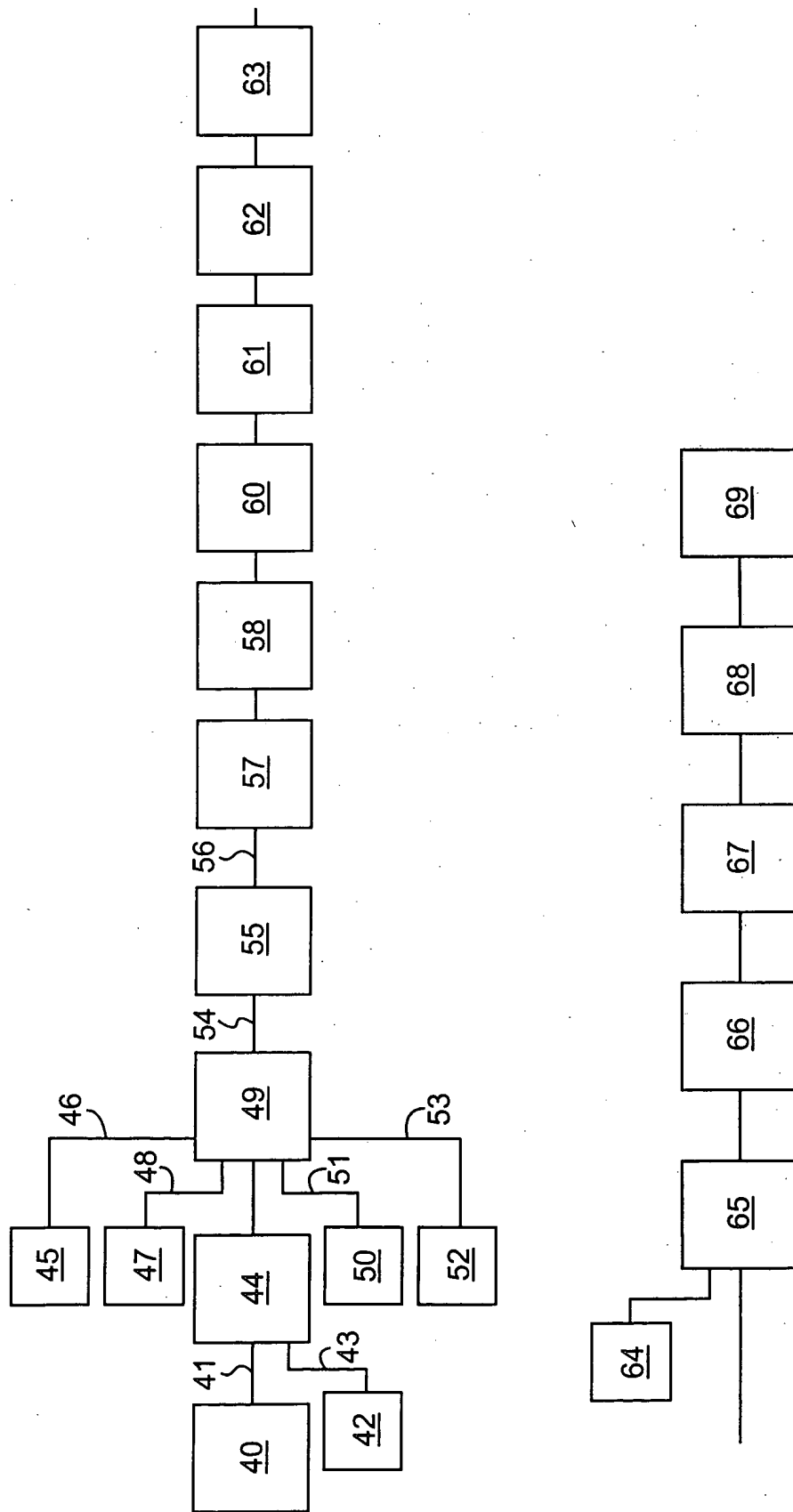
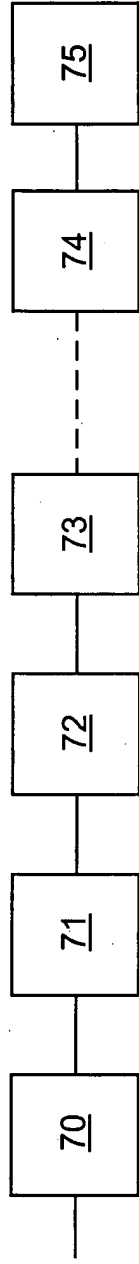
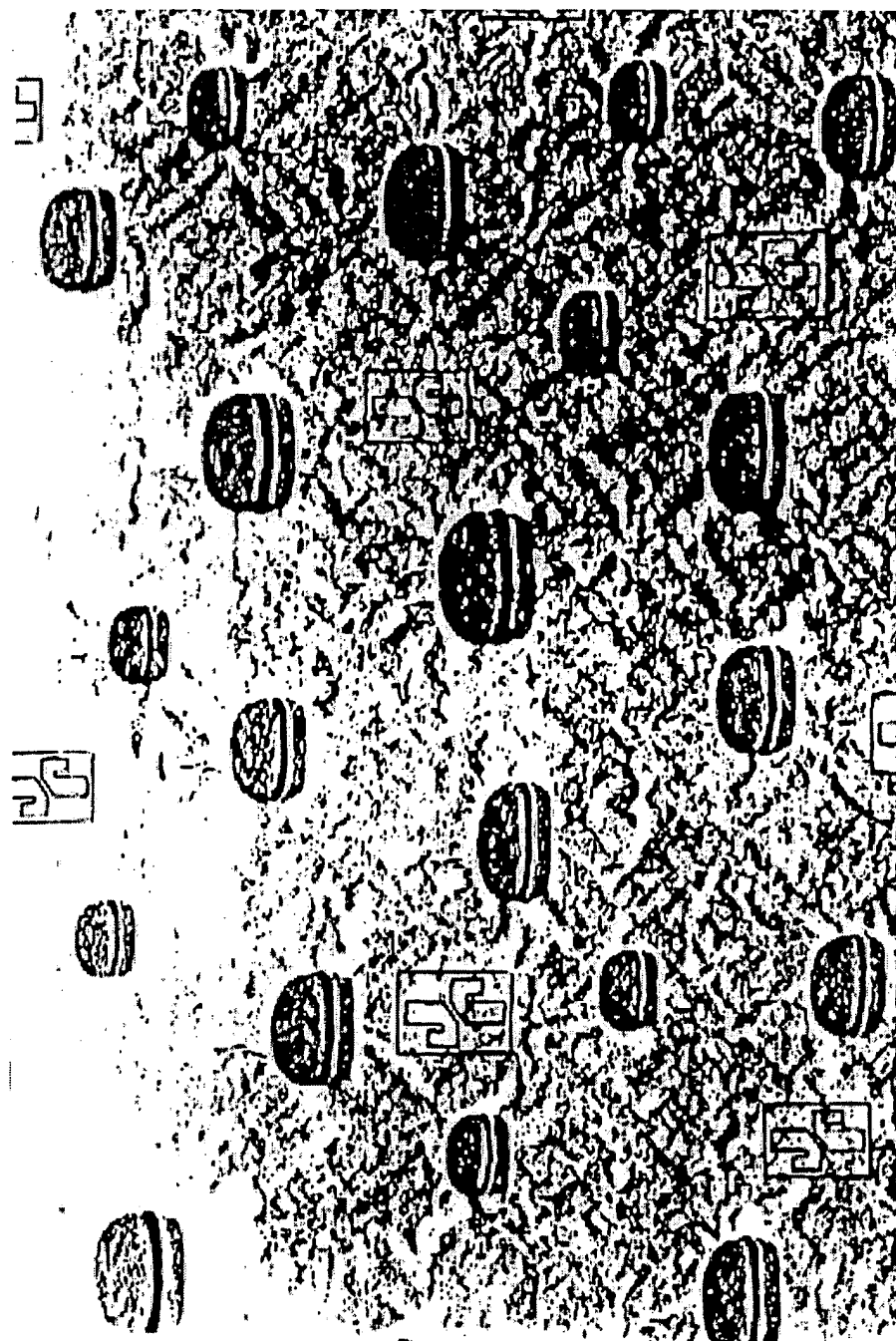


FIG. 35



**FIG. 36**



**FIG. 37**

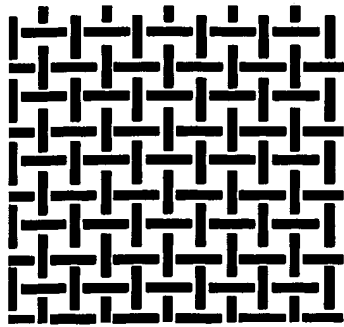


PLATE 4

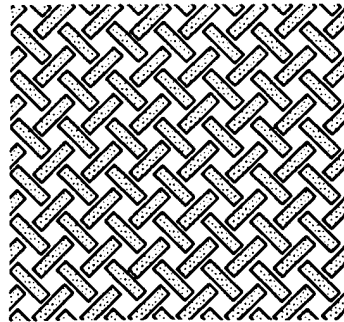


PLATE 3

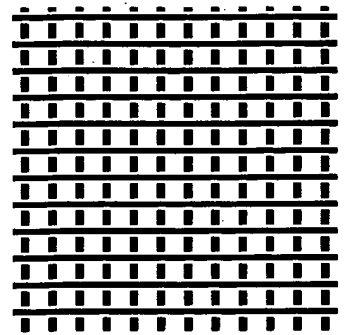


PLATE 2

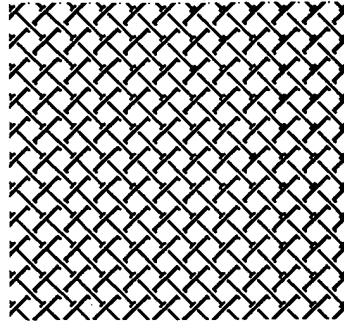
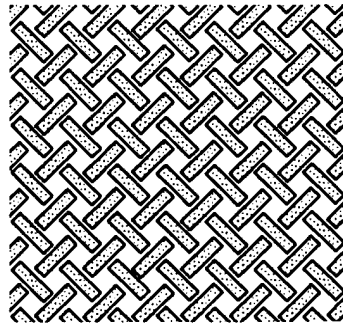
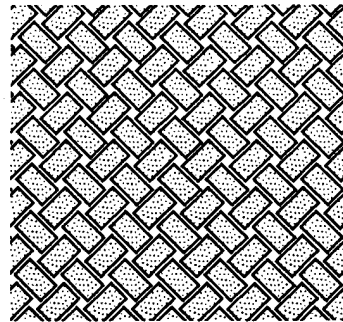


PLATE 1



CUP 3



CUP 2

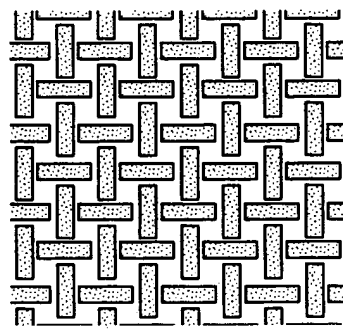


PLATE 6

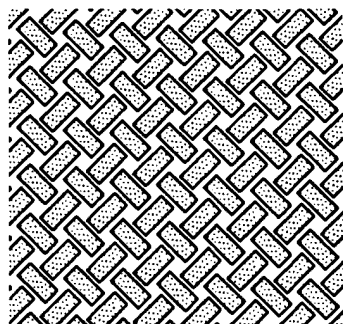
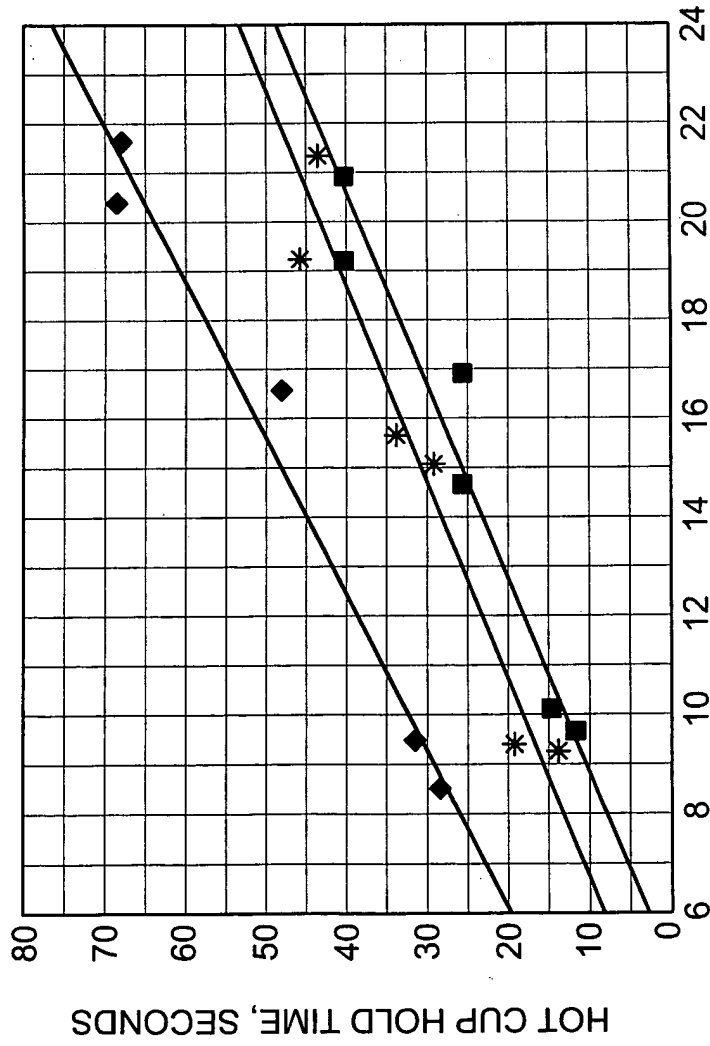


PLATE 5

**FIG. 38**

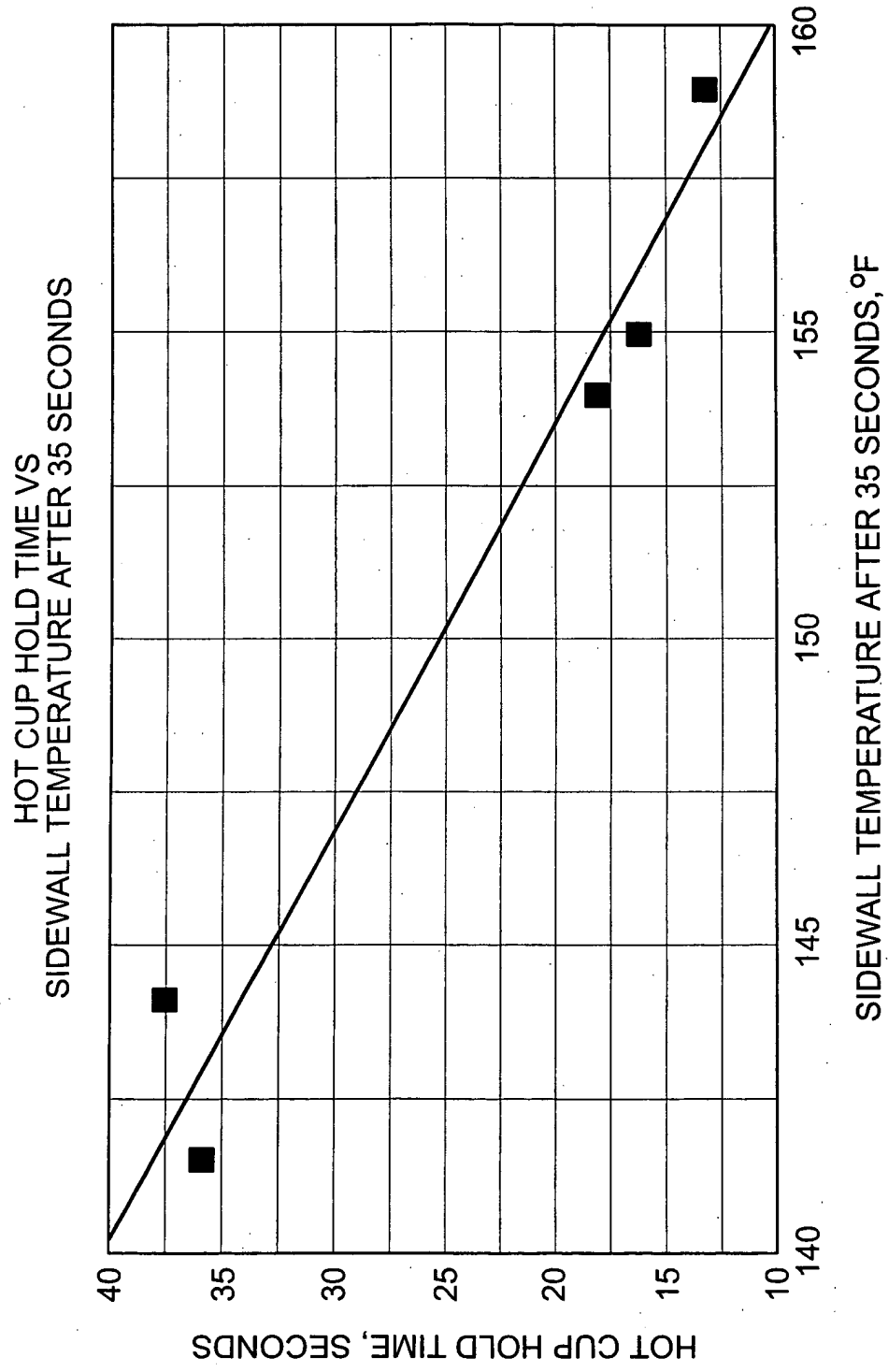


# HOT CUP HOLDING TIME VS COATING WEIGHT



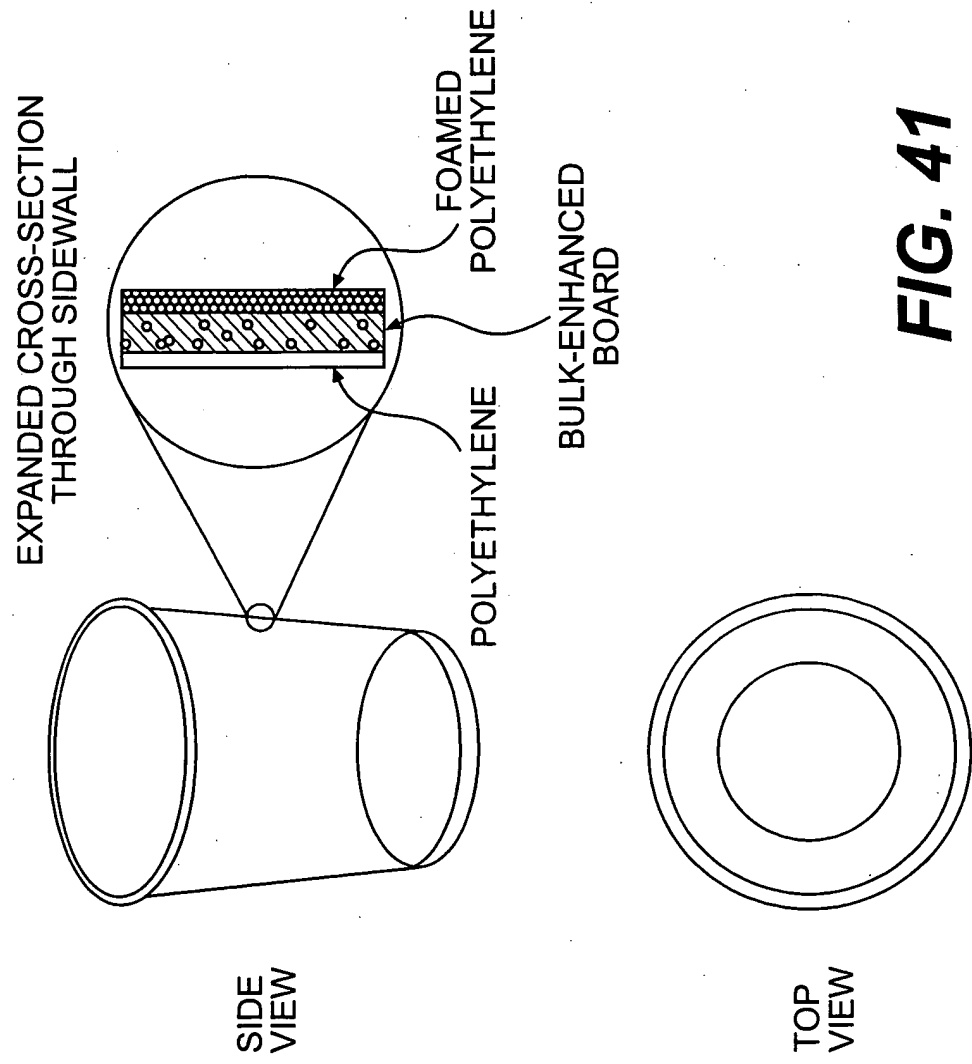
COATING WEIGHT, lb/R  
HOLD TIME WAS MEASURED WITH HEAT TRANSFER  
TEST USING THE TEMPERATURE MODEL

**FIG. 39**

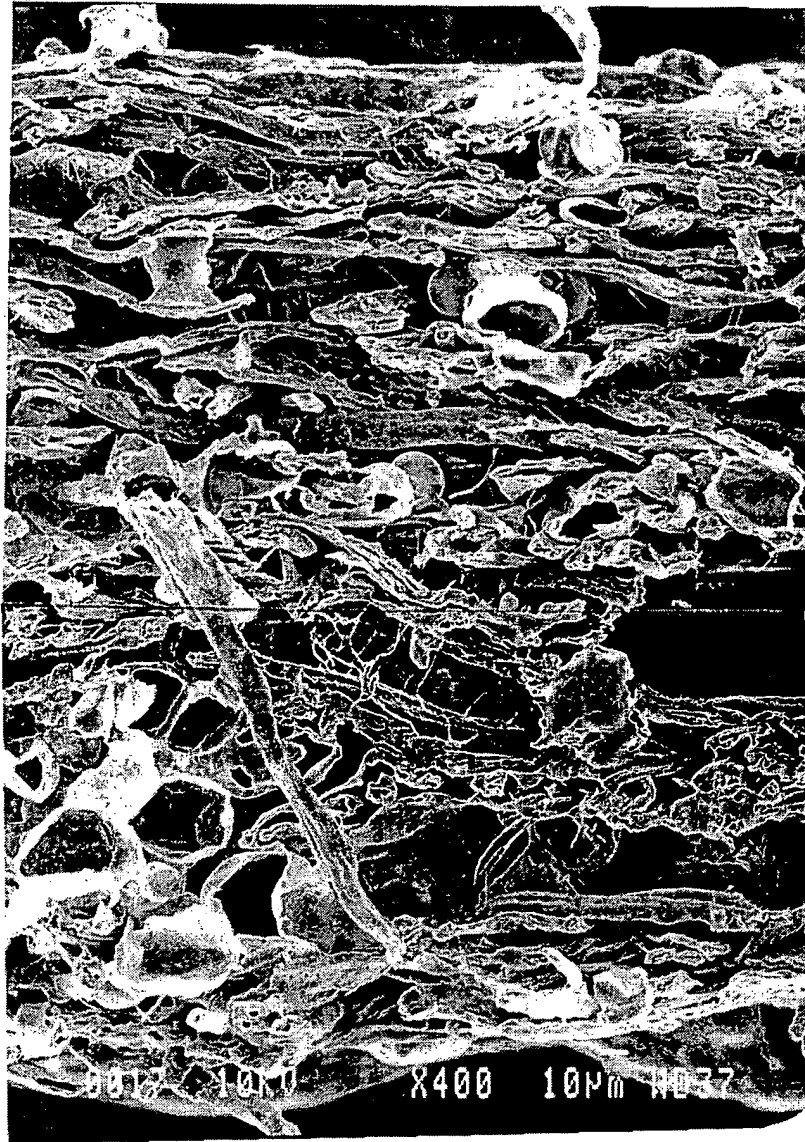


**FIG. 40**

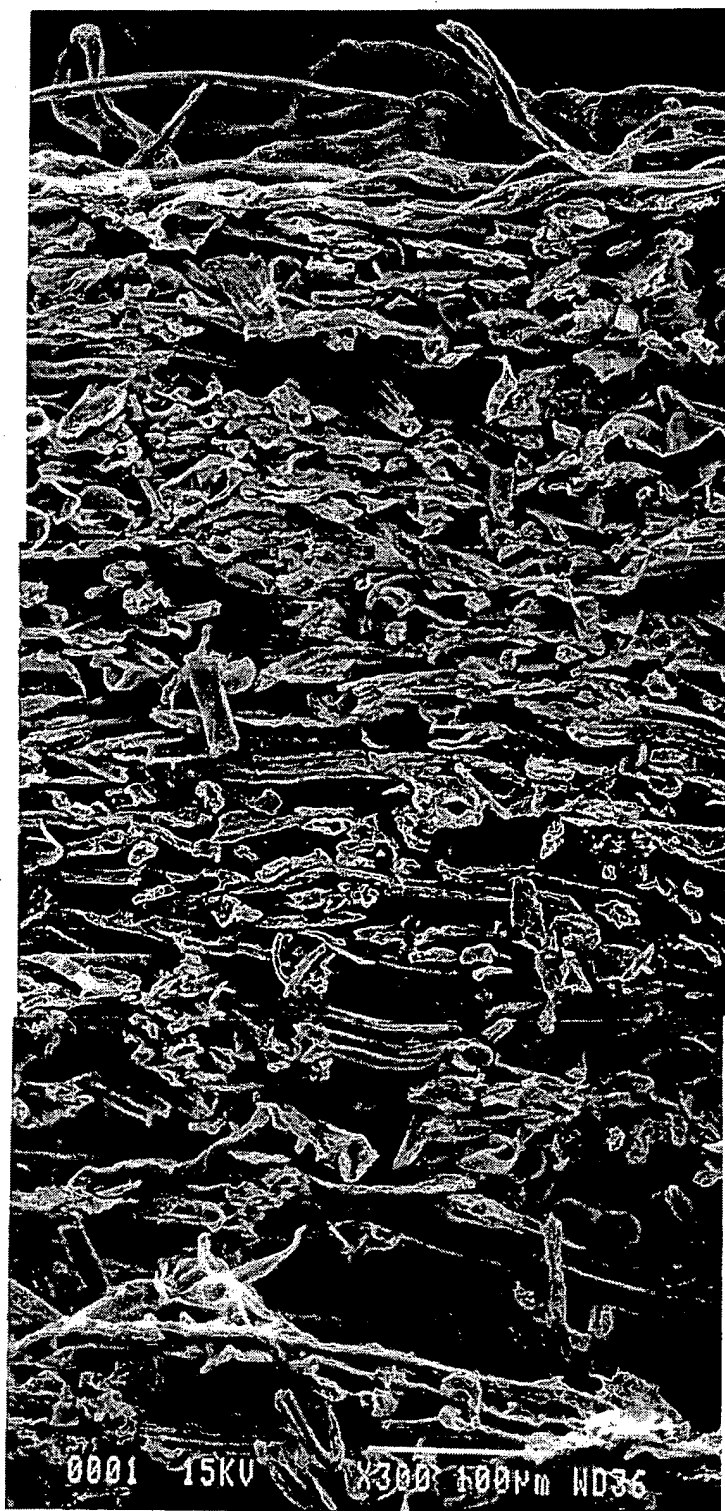
CUP WITH ADDITIONAL INSULATION FEATURE



**FIG. 41**

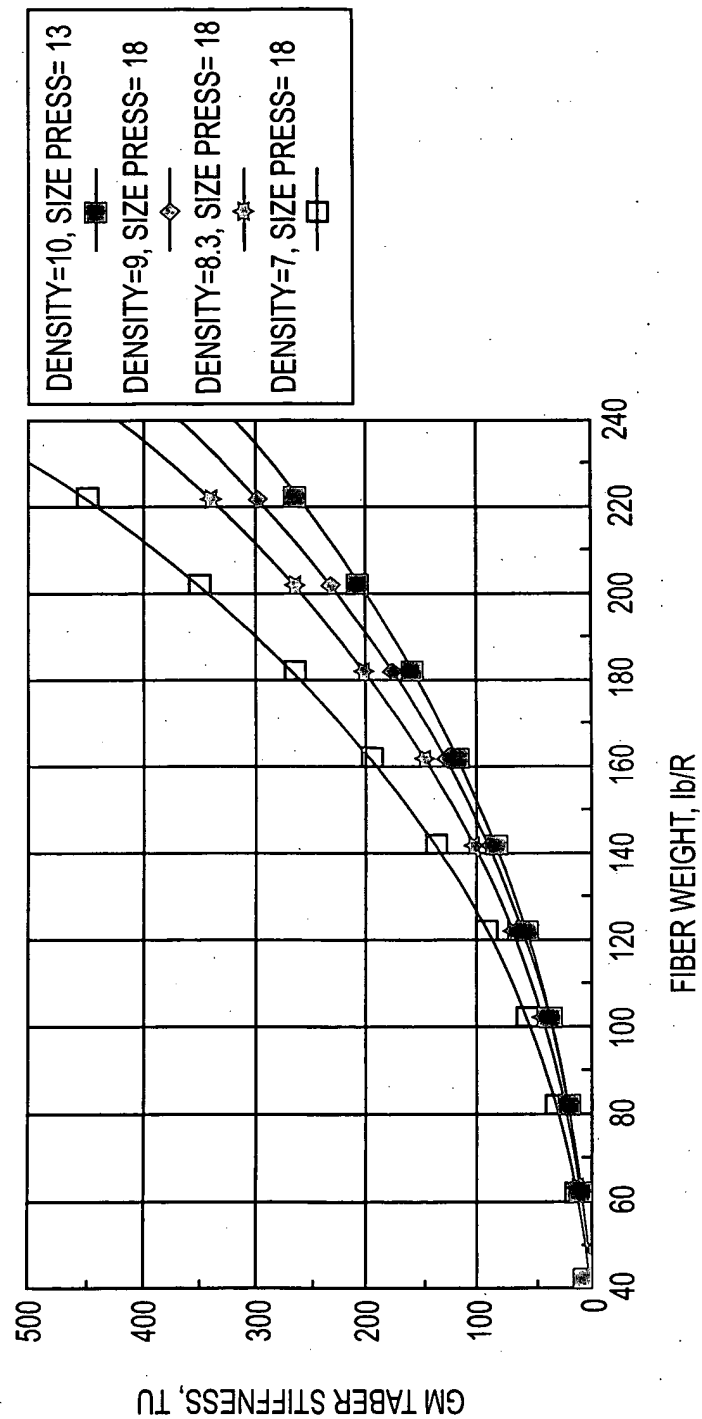


**FIG. 42**



**FIG. 43**

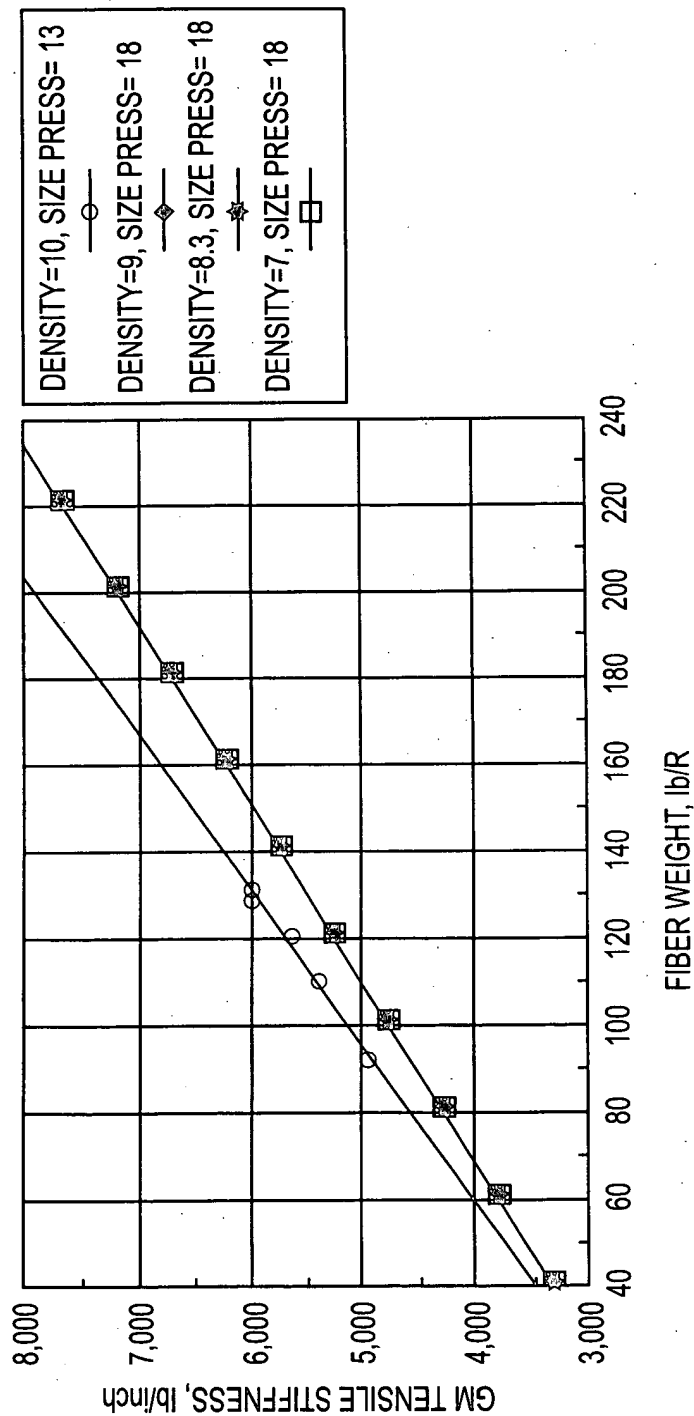
GM TABER STIFFNESS VS FIBER WEIGHT, FIBER DENSITY, AND SIZE PRESS WEIGHT  
FOR BENDTSEN SMOOTHNESS AT 400 OR LESS



1. DENSITY VALUES SHOWN ARE FIBER MAT DENSITIES. (FIBER WEIGHT/CALIPER)

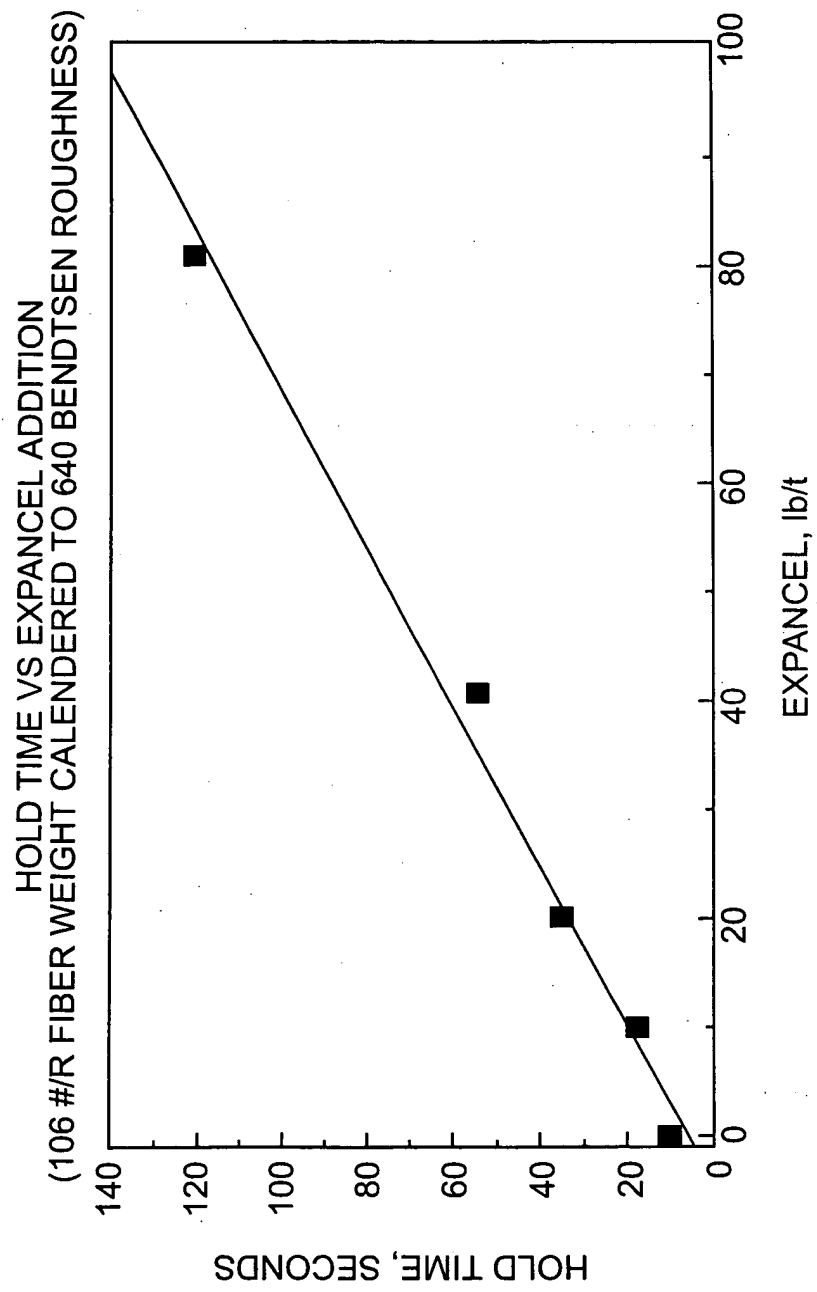
**FIG. 44**

GM TENSILE STIFFNESS VS FIBER WEIGHT, FIBER DENSITY, AND SIZE PRESS WEIGHT  
FOR BENDTSEN SMOOTHNESS AT 400 OR LESS



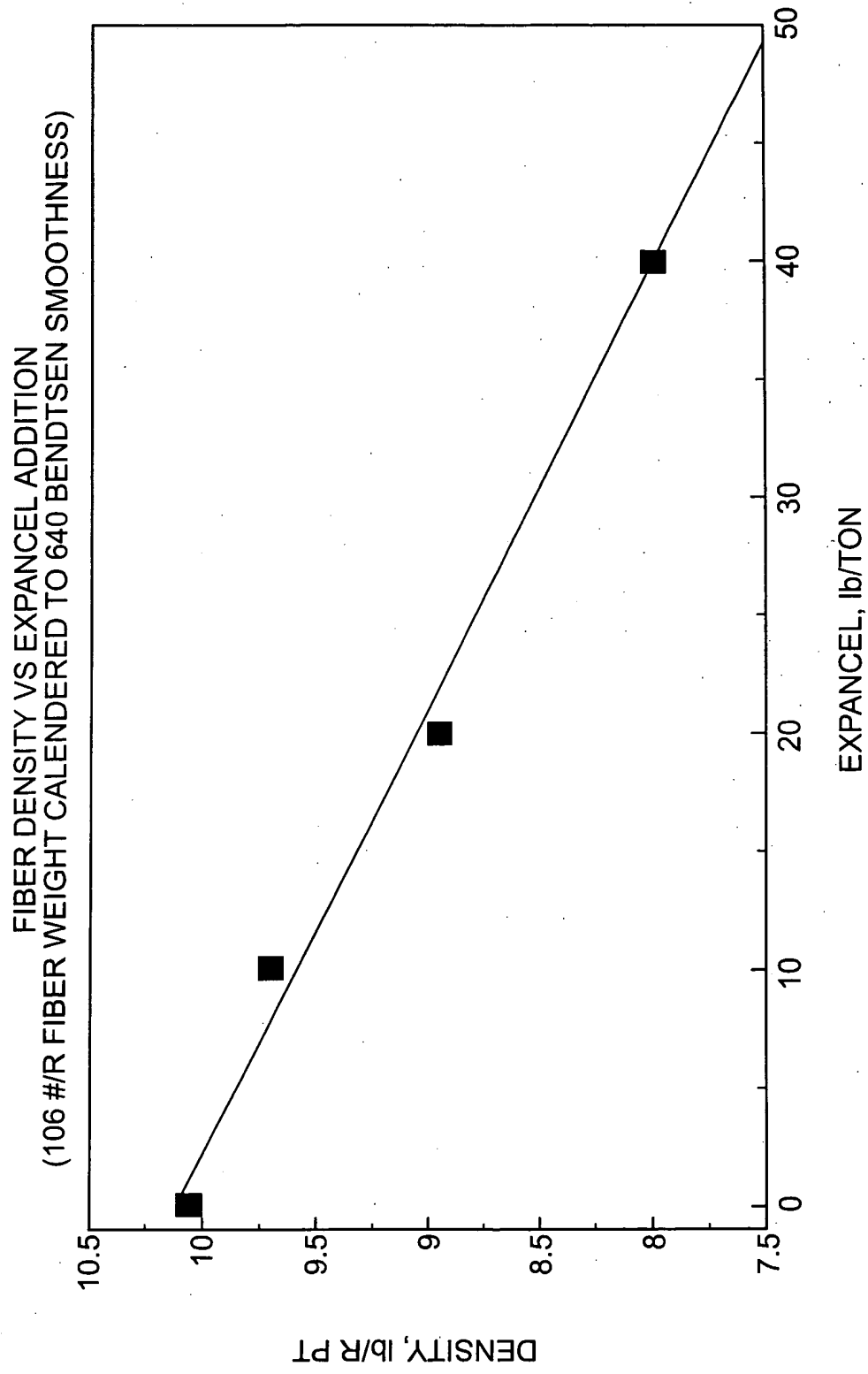
1. DENSITY VALUES SHOWN ARE FIBER MAT DENSITIES. (FIBER WEIGHT/CALIPER)

FIG. 45



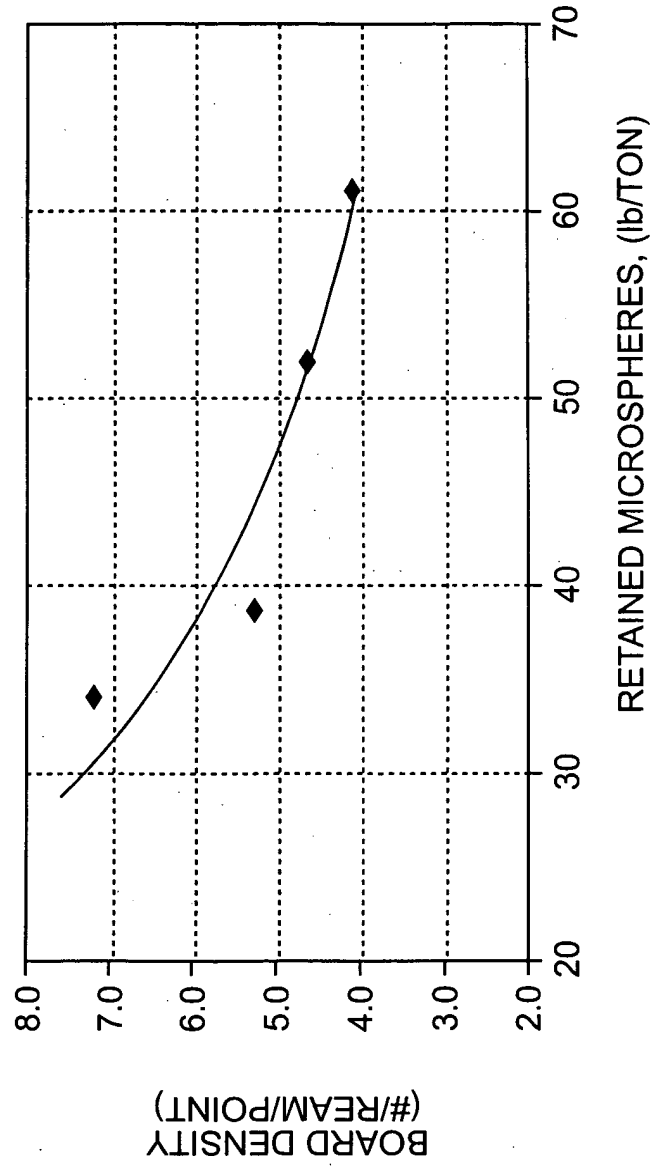
**FIG. 46**



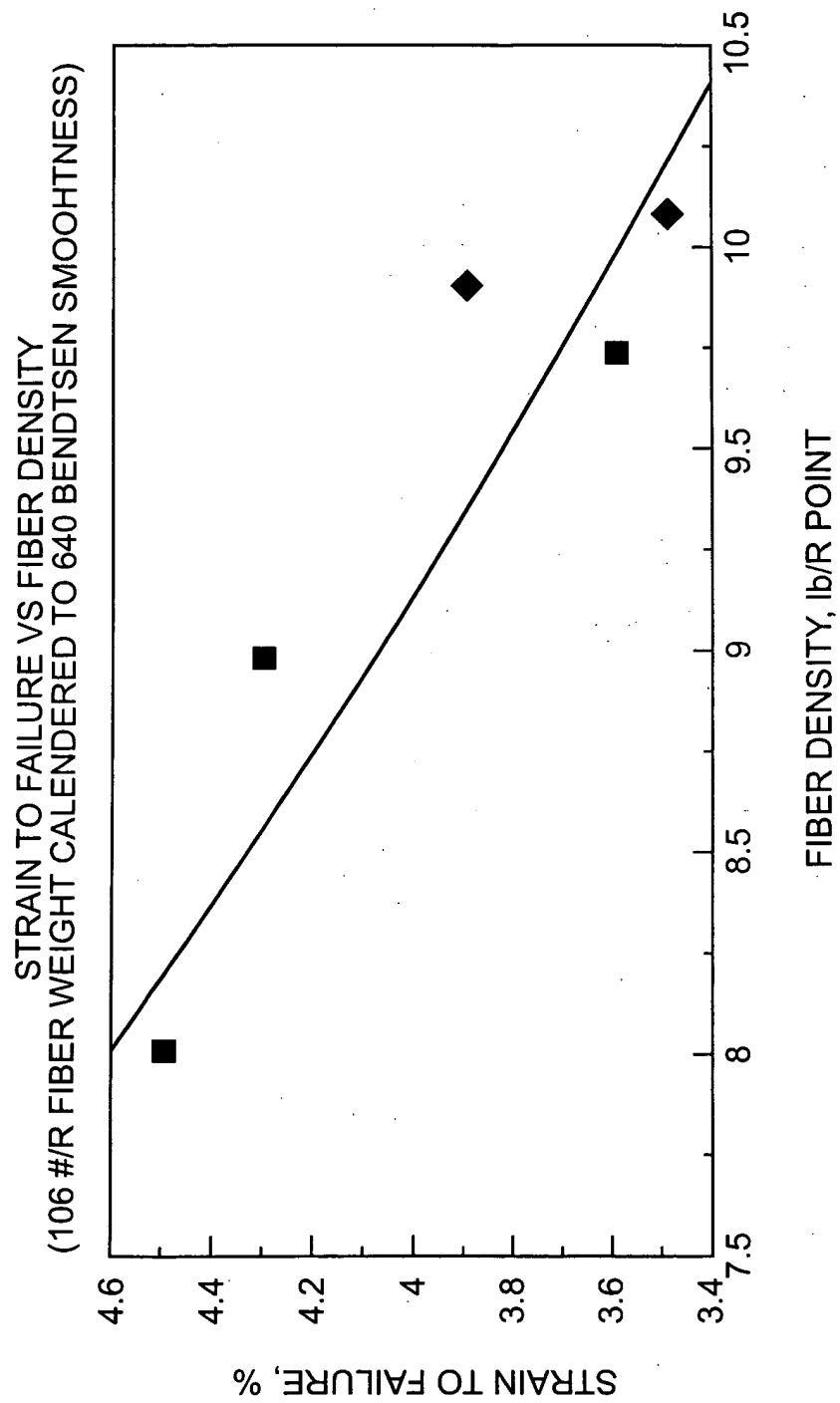


**FIG. 47**

EFFECT ON BOARD DENSITY OF  
INCREASING THE AMOUNT OF RETAINED  
MICROSPHERES

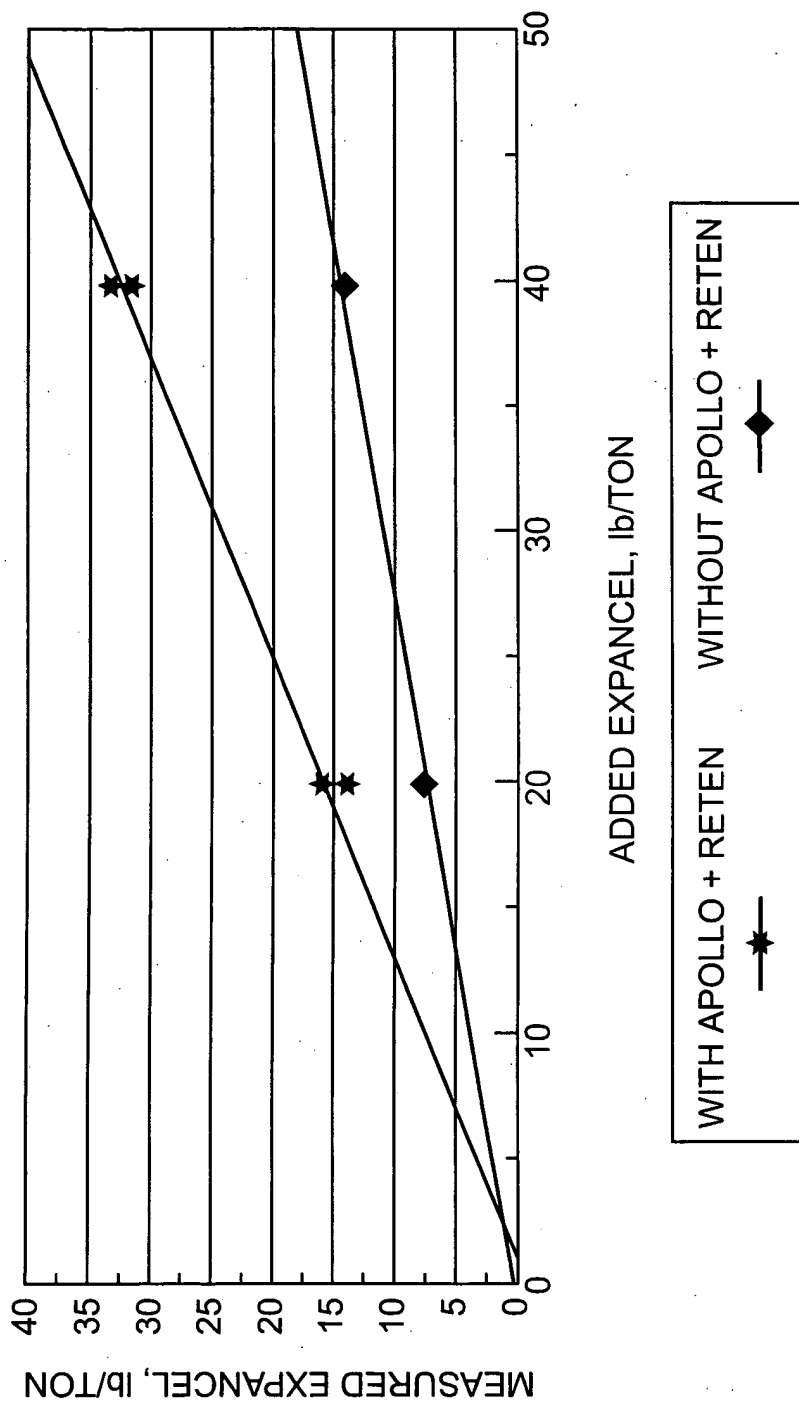


**FIG. 48**



**FIG. 49**

# EXPANCEL 820 RETENTION (MEASURED EXPANCEL VS ADDED EXPANCEL)



1. EXPANCEL RETENTION WITH APOLLO + RETEN=83%
2. EXPANCEL RETENTION WITHOUT APOLLO + RETEN=36%

**FIG. 50**

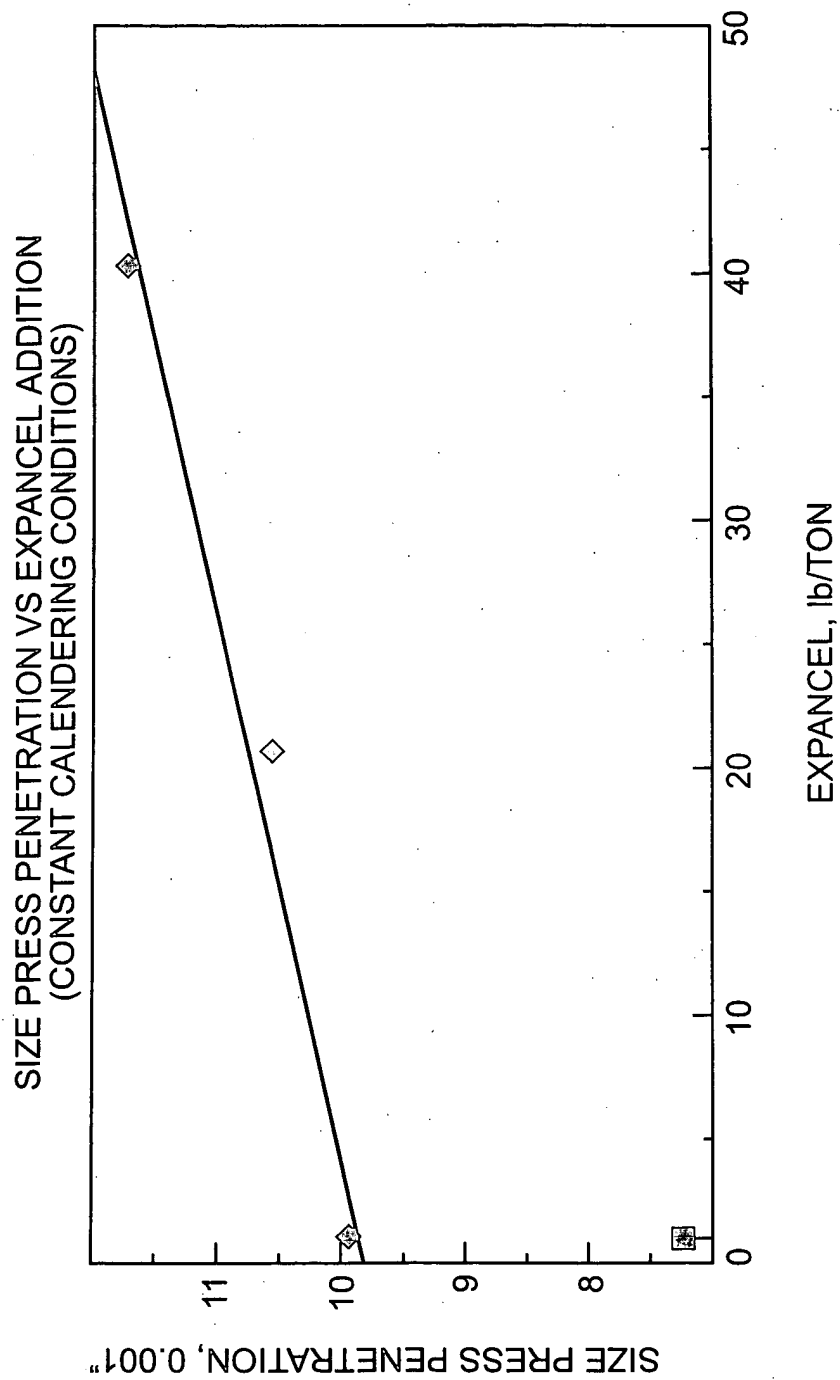


FIG. 51

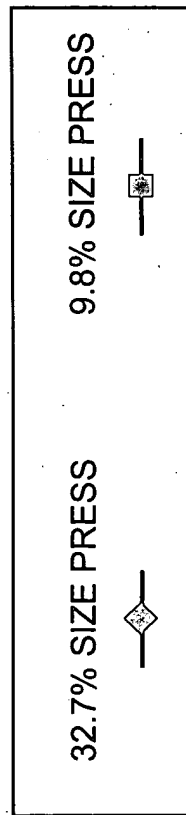
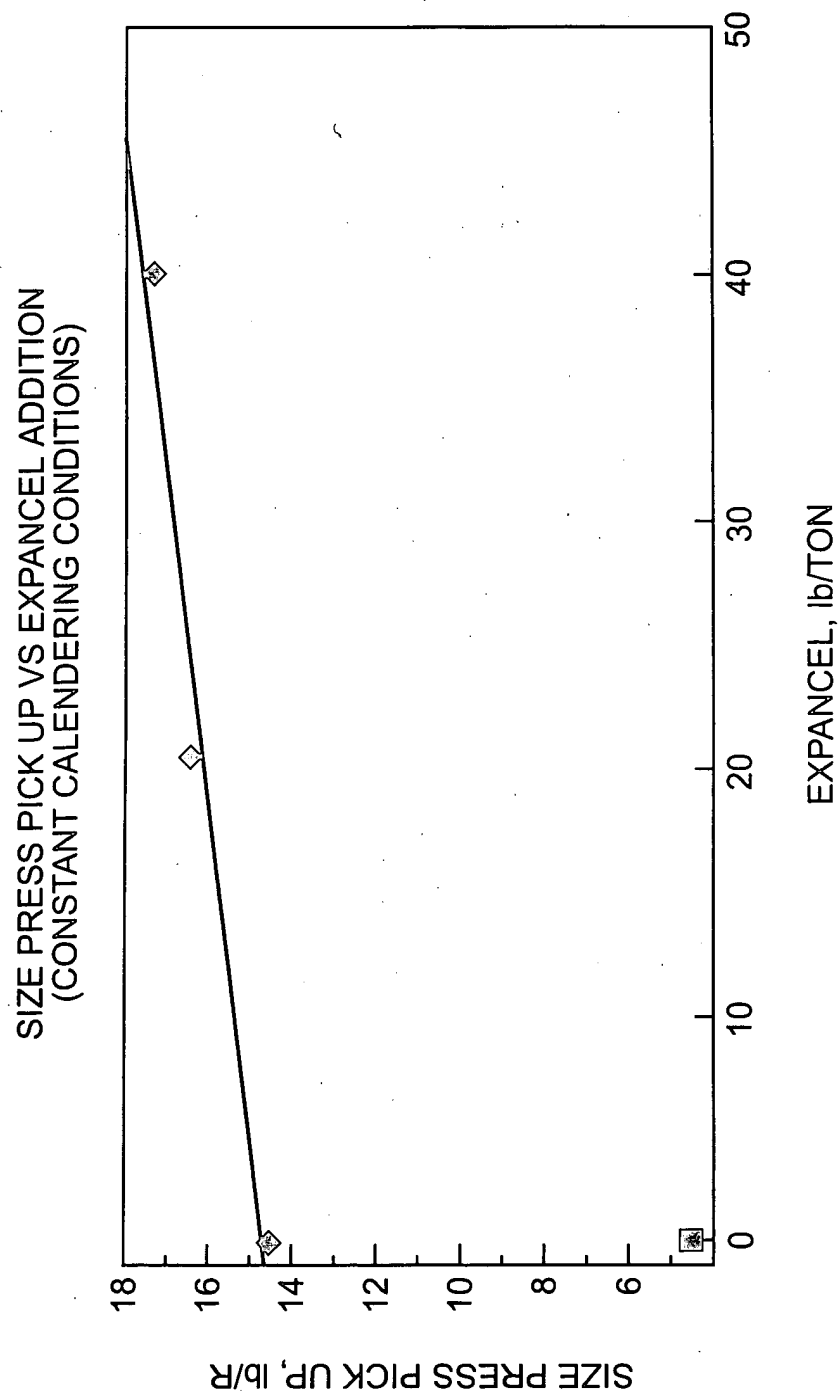
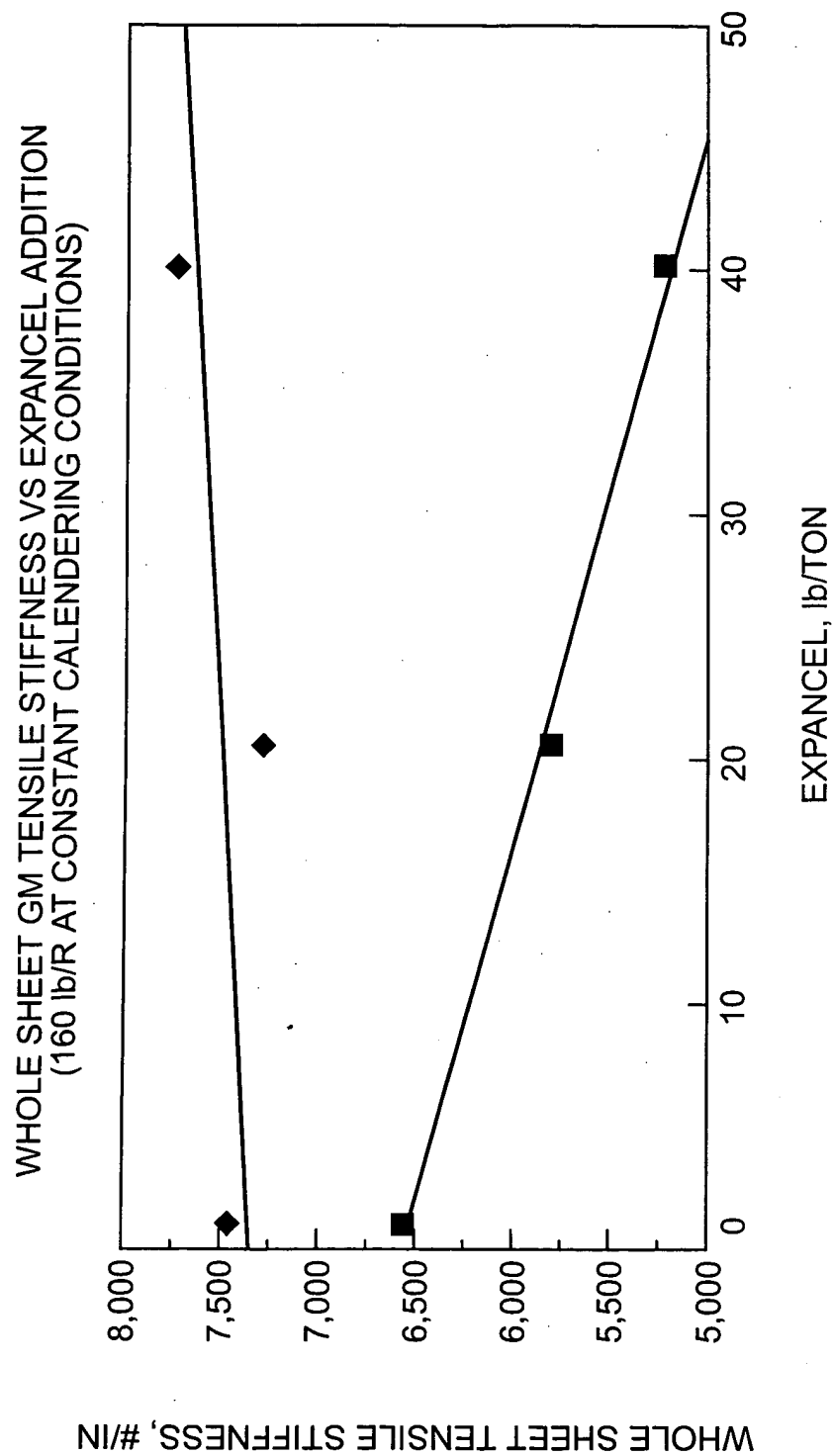
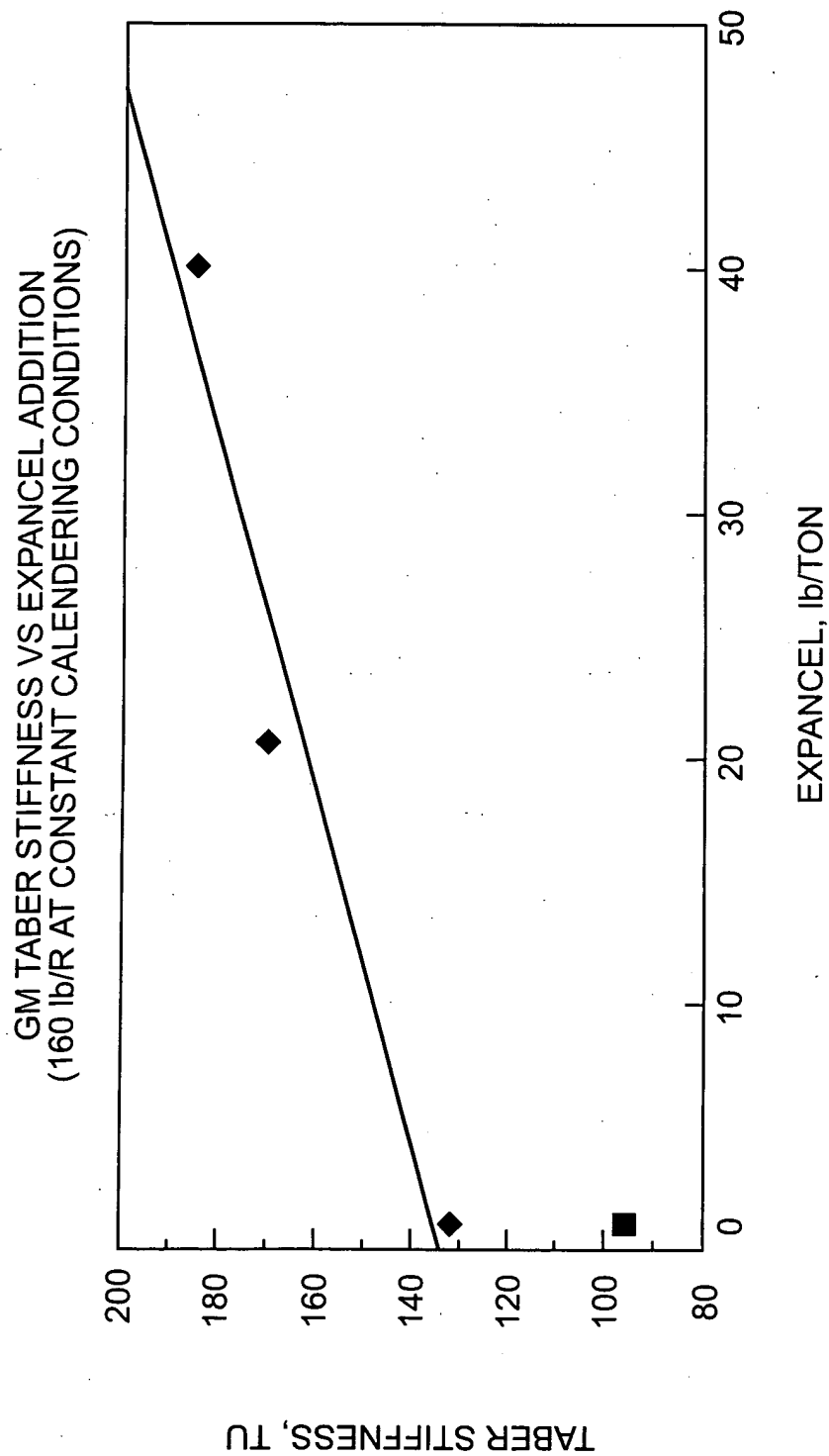


FIG. 52



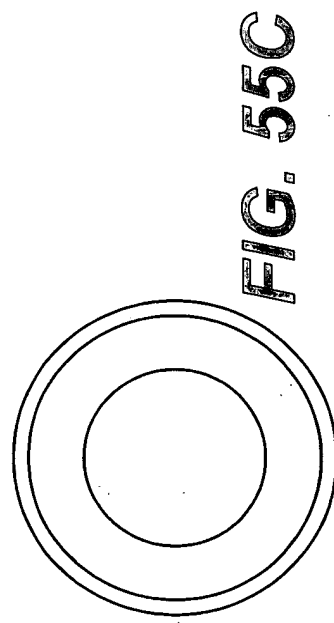
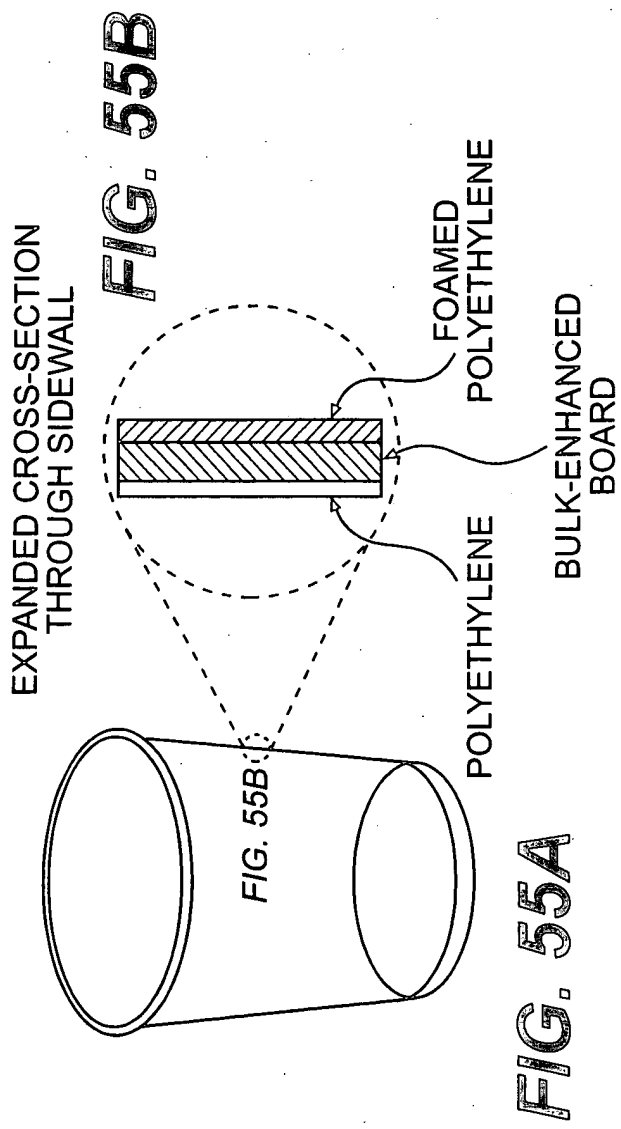
**FIG. 53**

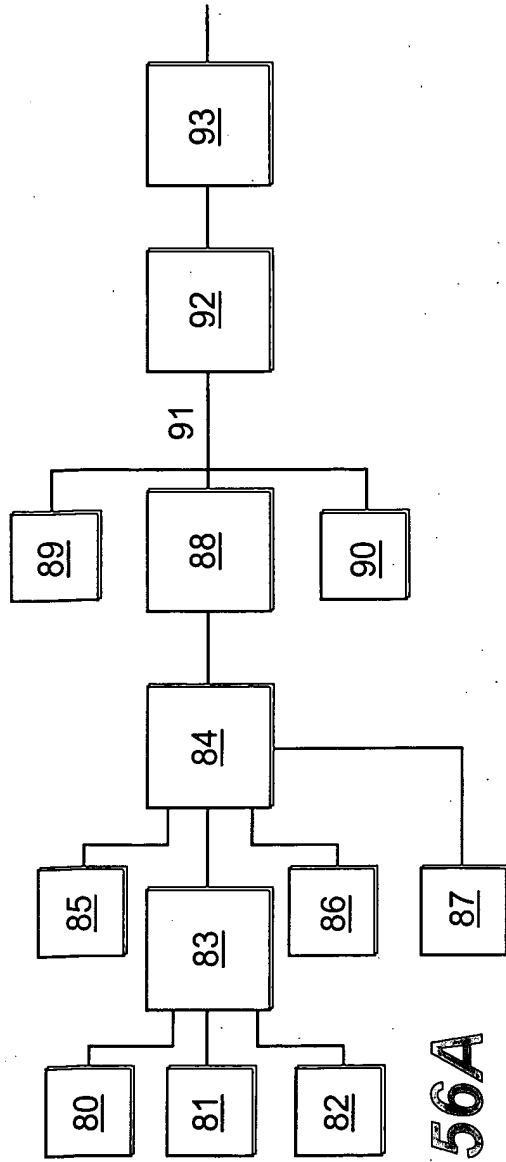


**FIG. 54**

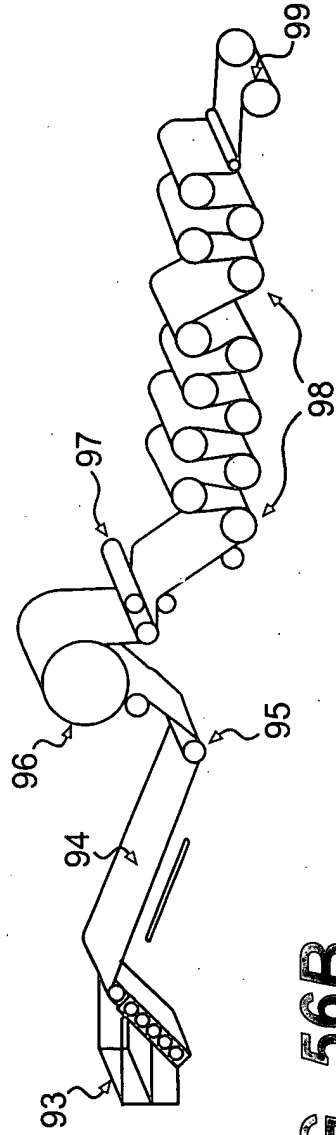


CUP WITH ADDITIONAL INSULATION FEATURE





**FIG. 56A**



**FIG. 56B**

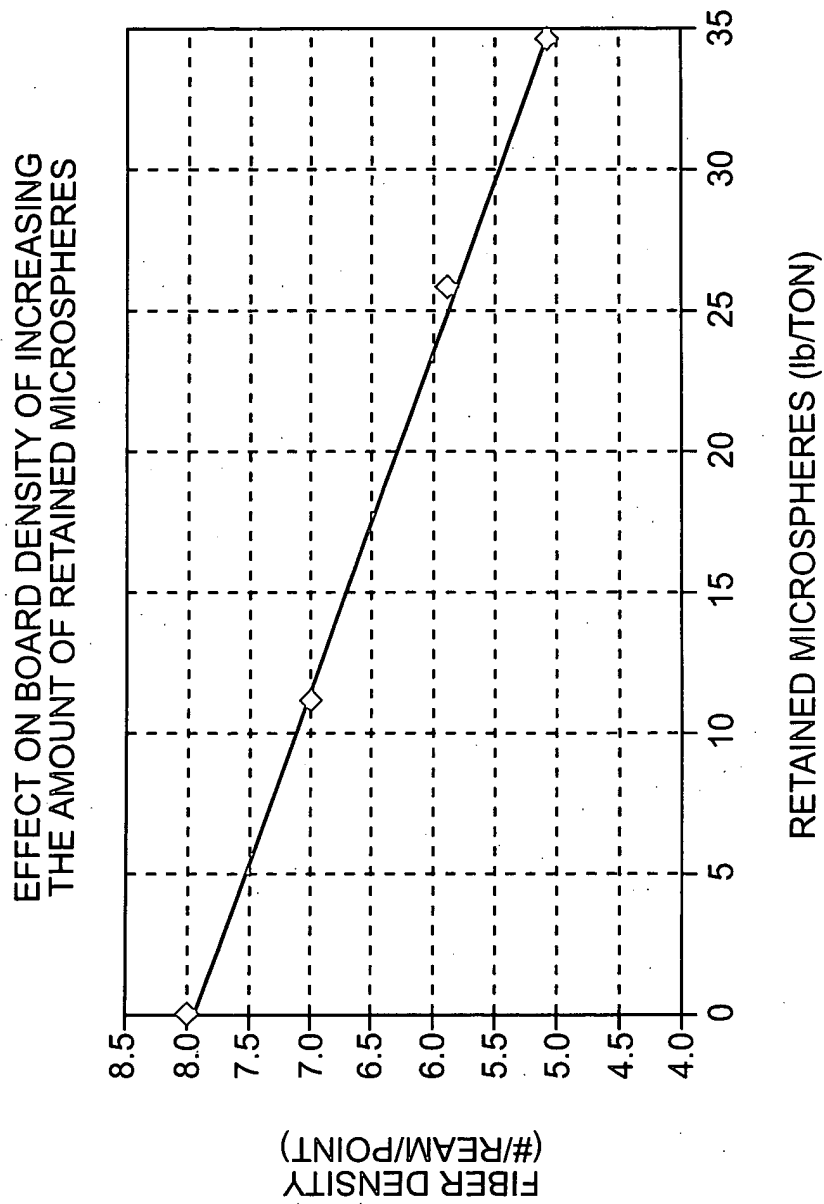
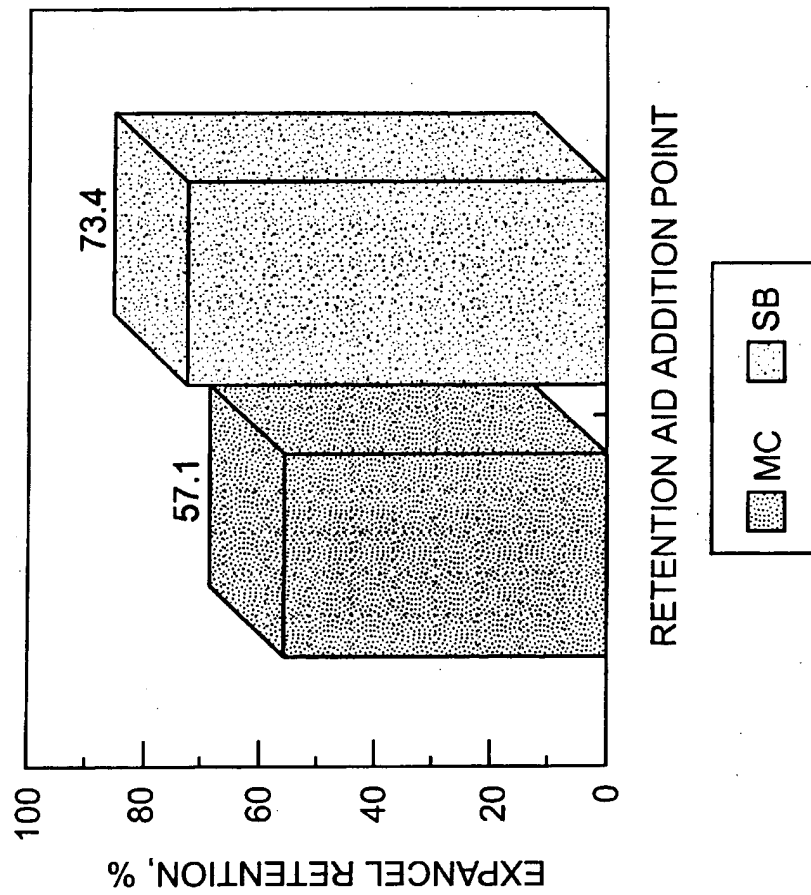


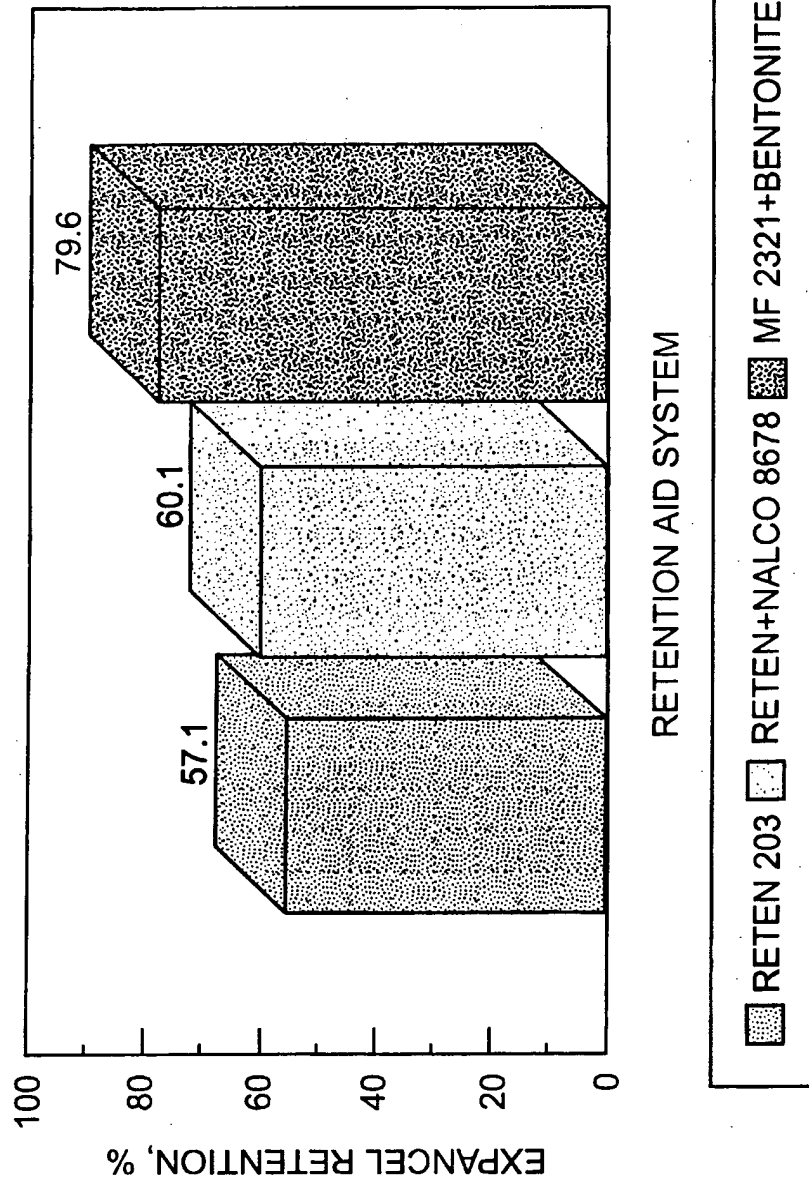
FIG. 57

EXPANCEL 820WU RETENTION  
RETEN 203 RETENTION AID  
(MACHINE CHEST ADDITION OF ADDITIVES VS STUFF BOX ADDITION)



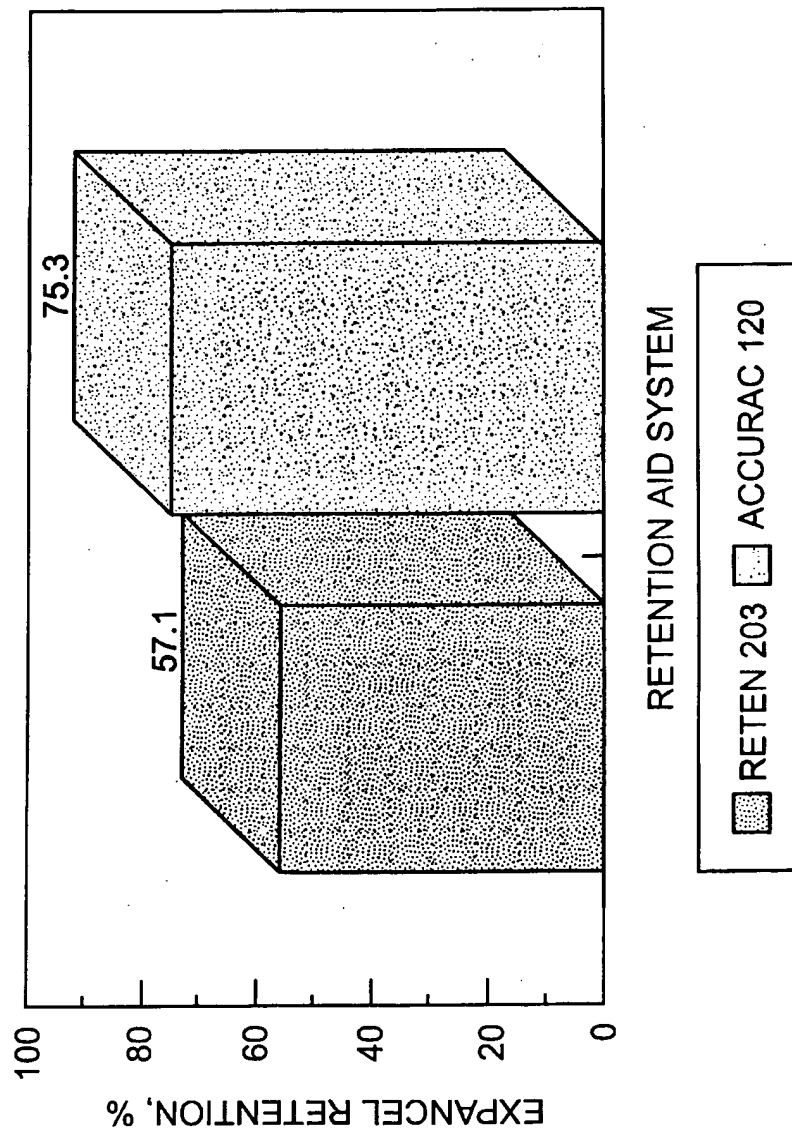
**FIG. 58A**

EXPANCEL 820WU RETENTION  
MICROPARTICLE RETENTION AIDS  
(BENTONITE VS ORGANIC COLLOID)



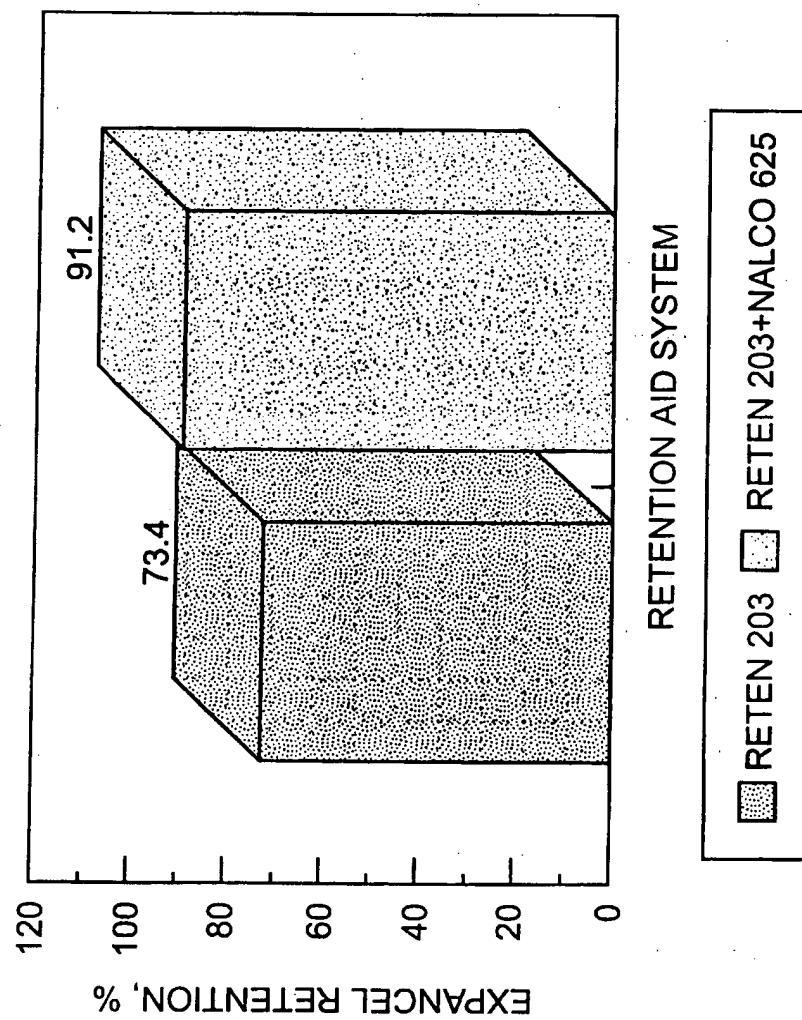
**FIG. 58B**

EXPANCEL 820WU RETENTION  
HIGH MOLECULAR WEIGHT CATIONIC RETENTION AIDS



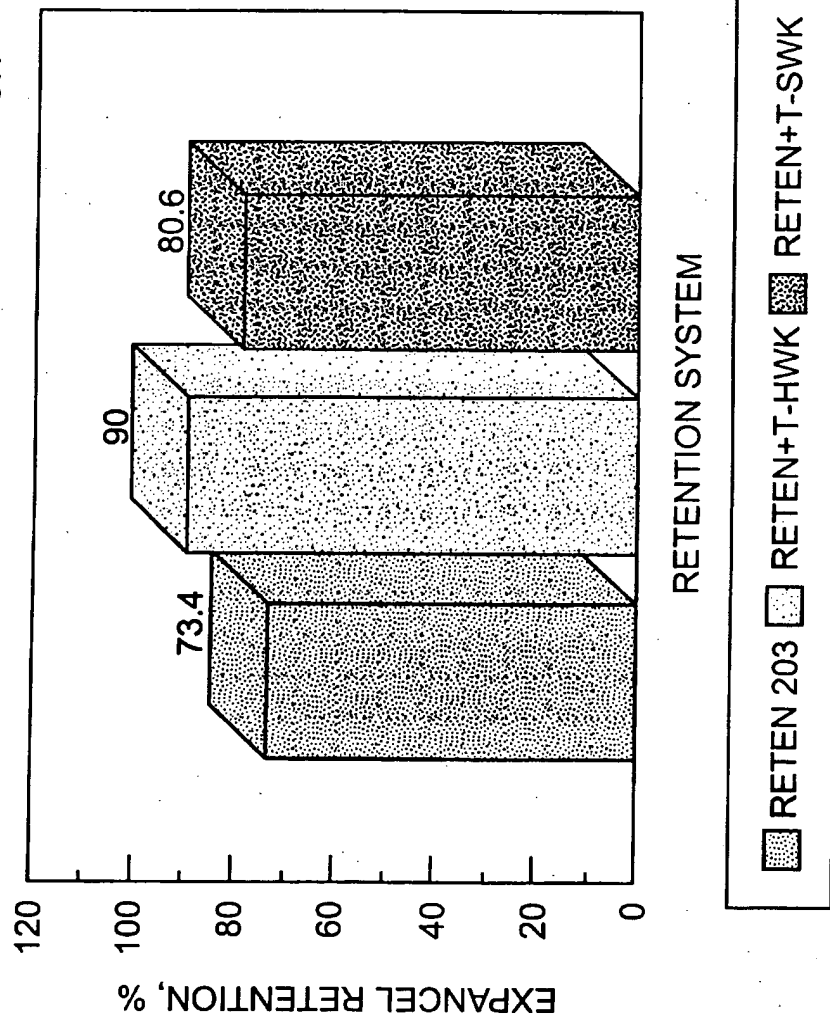
**FIG. 58C**

EXPANCEL 820WU RETENTION  
DUAL POLYMER RETENTION AIDS



**FIG. 58D**

# EXPANCEL 820WU RETENTION IMPACT OF THERMAL FIBER UPON RETENTION



**FIG. 58E**



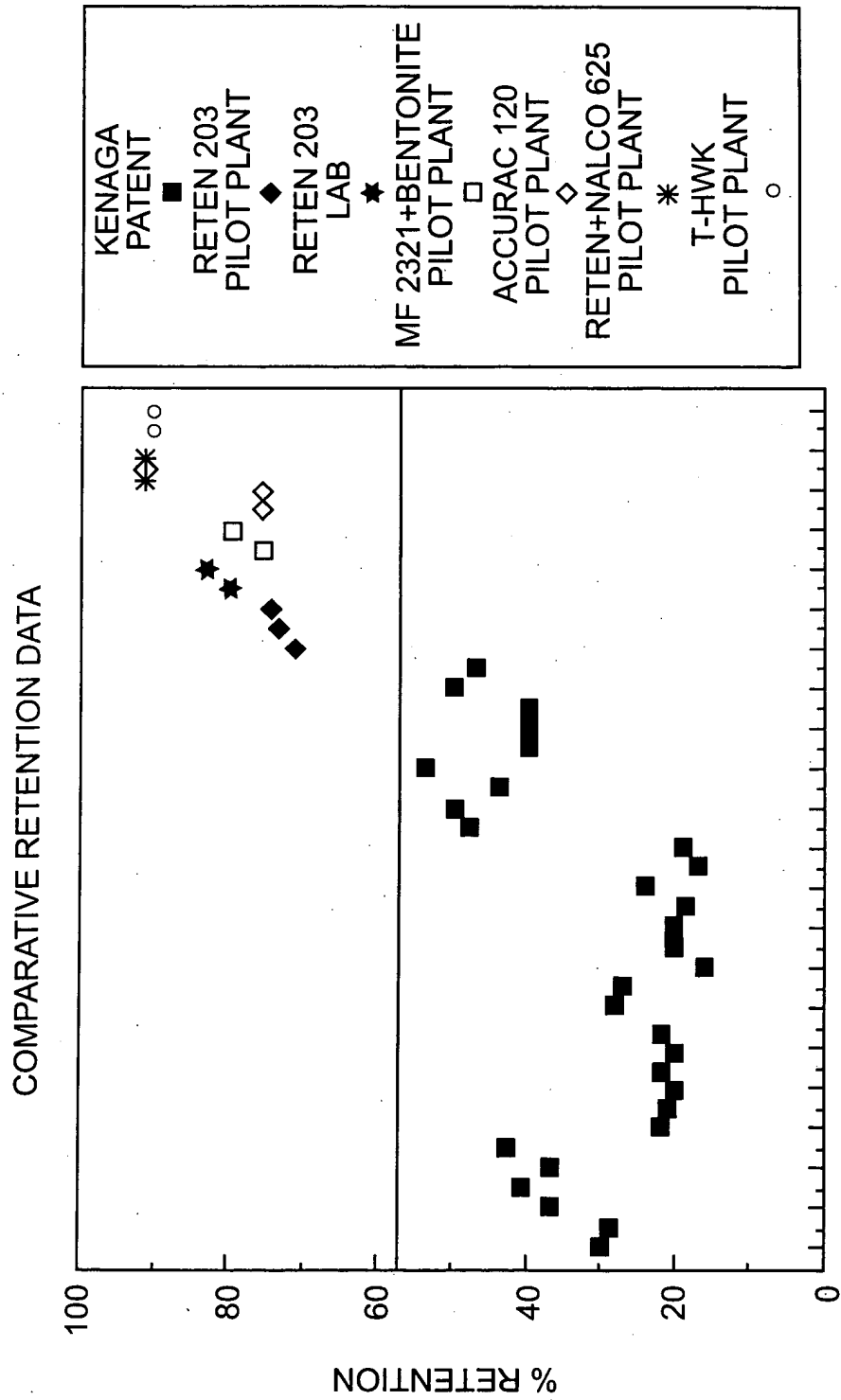
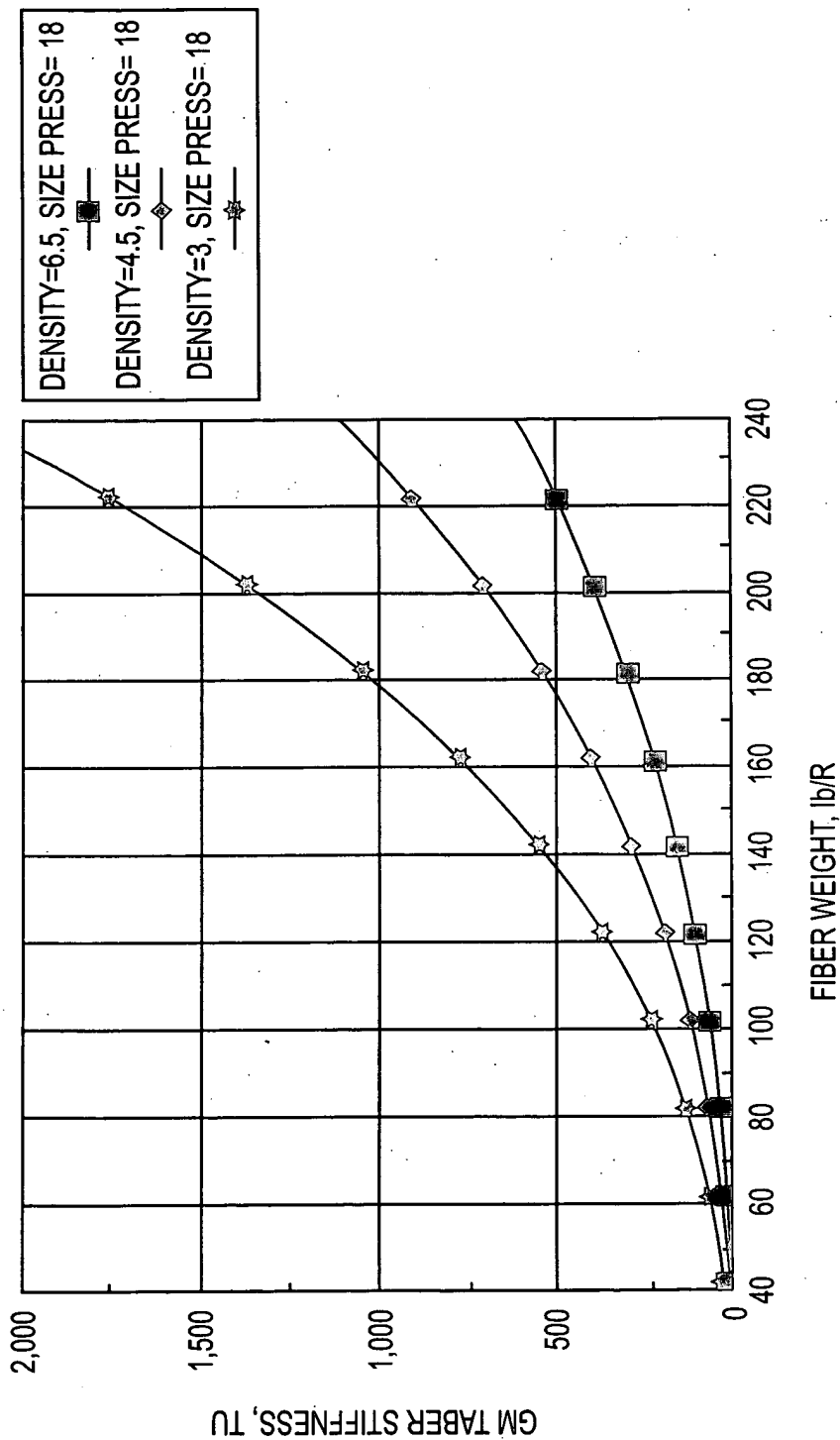


FIG. 59

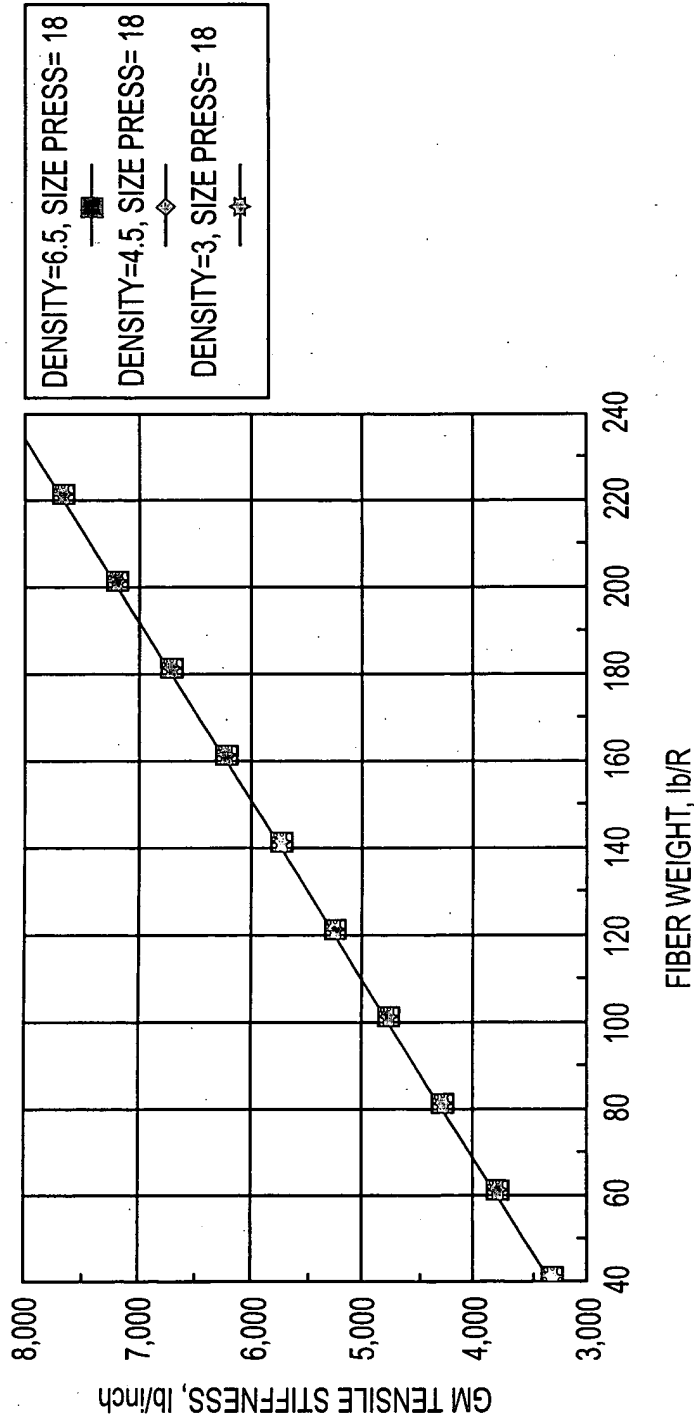
GM TABER STIFFNESS VS FIBER WEIGHT, FIBER DENSITY, AND SIZE PRESS WEIGHT  
FOR BENDTSEN SMOOTHNESS AT 400 OR LESS



1. DENSITY VALUES SHOWN ARE FIBER MAT DENSITIES. (FIBER WEIGHT/CALIPER)

FIG. 60

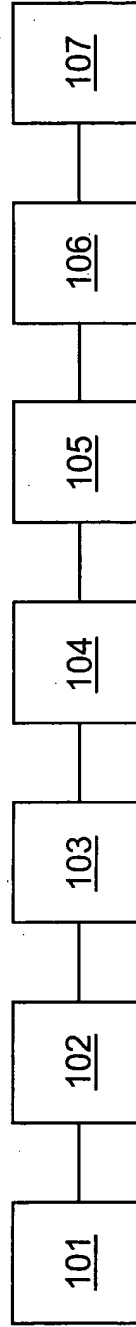
GM TABER STIFFNESS VS FIBER WEIGHT, FIBER DENSITY, AND SIZE PRESS WEIGHT  
FOR BENDTSEN SMOOTHNESS AT 400 OR LESS



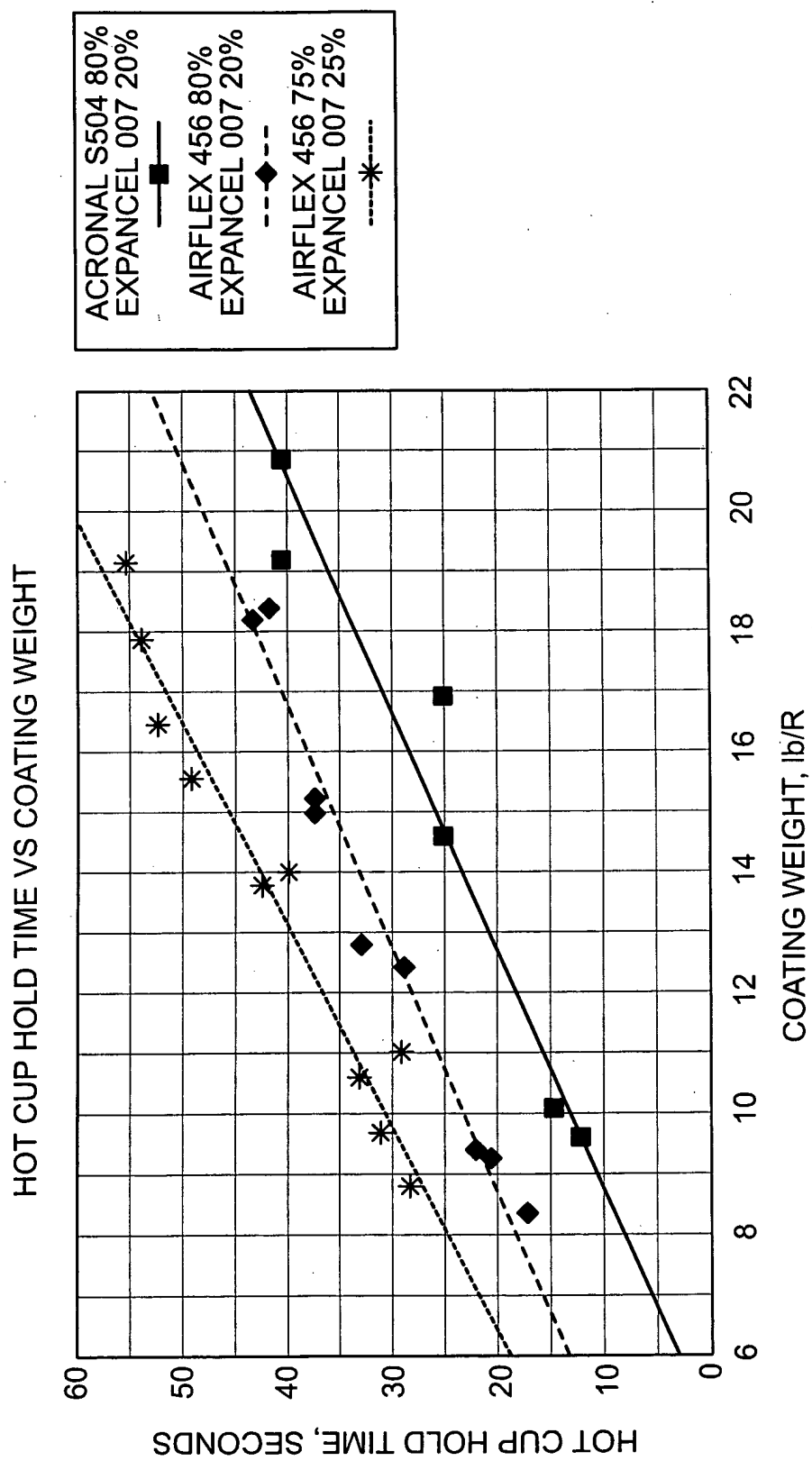
1. DENSITY VALUES SHOWN ARE FIBER MAT DENSITIES. (FIBER WEIGHT/CALIPER)

**FIG. 61**

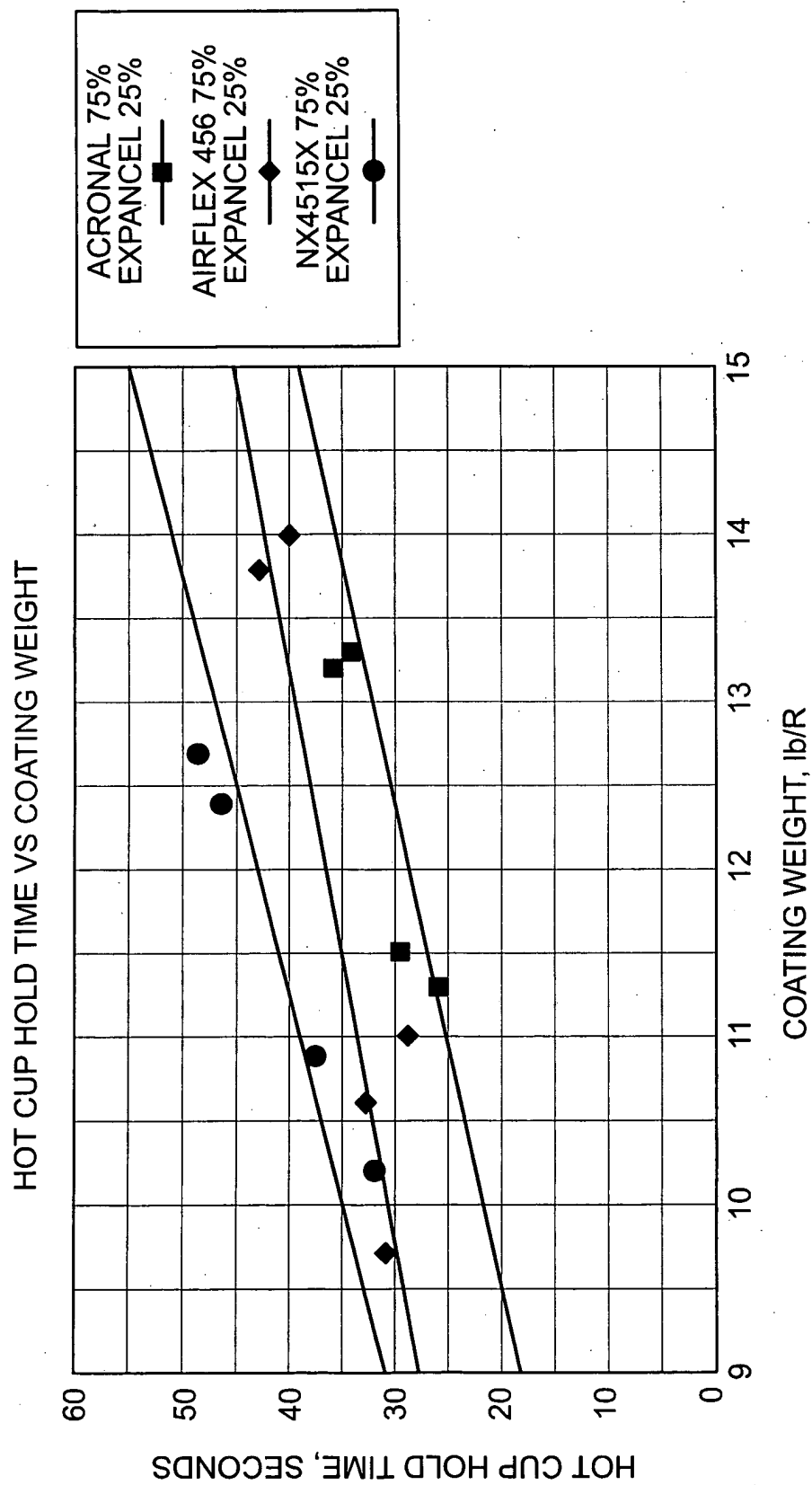
PROCESS FOR MANUFACTURING  
WAX-TREATED CUPS



**FIG. 62**



**FIG. 63**



**FIG. 64**